

VOLUME CIV

NUMBER TWO

THE NATIONAL GEOGRAPHIC MAGAZINE

AUGUST, 1953

Safari Through Changing Africa 145

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Sixty-four Pages of Illustrations in Color

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C.

\$6.50 A YEAR

65¢ THE COPY



Safari Through Changing Africa

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By ELSIE MAY BELL GROSVENOR

With Illustrations by Gilbert Grosvenor, President, National Geographic Society

AT 3 O'CLOCK on a pitch-dark January morning, a big four-engined air liner set us down at Kano in the heart of Africa. We had boarded the plane the evening before on the outskirts of busy, cosmopolitan Rome, 2,000 miles away.

Now, before we could leave the cabin, a tall Negro dressed in khaki came aboard and sprayed us all with disinfectant. As a parting gift, the airline stewardess gave us each a box of paludrine pills and some sound advice: take one each day and we wouldn't catch malaria.

Then we stepped out into the night. Africa was cold! A chill wind blew from the desert we had just flown over, and I shivered as I stumbled toward the airport building.

It was nearly 4 o'clock before we reached the home of Mr. Kenneth P. Maddocks, the British Resident, where we were to stay while in Kano. But if Mr. and Mrs. Maddocks were upset by having guests drop from the sky at 4 in the morning, they didn't show it. They welcomed us in their wrappers and gave us hot tea and crackers to dispel the chill. We used three woolen blankets on our beds—and a hot-water bottle besides.

Only the mosquito nets draped around us—we found them everywhere we went in Africa—reminded us we were in "tropical" Nigeria, just 12 degrees north of the Equator (map, page 150).

Why We Searched a Continent

This was the beginning of a three-month 30,000-mile safari around Africa for my husband, Gilbert Grosvenor, and me.

The trip was partly a delayed celebration for our golden wedding anniversary. More important, it was a search for fresh material and new ideas and authors for the NATIONAL GEOGRAPHIC MAGAZINE.

Similar quests in other years had taken us to the ancient Inca ruins of Machu Picchu on a flight across the Andes in Peru; the chilly summits of China's holy mountain, Tai Shan, and of Japan's Fuji; Hawaii, Midway, and Wake Islands; every Province of Canada; Europe; every State of the United States; and two Russias, Tsarist and Soviet.

Africa itself was not wholly new to us. Many years earlier we had visited Spanish and French Morocco; we had drunk tea with a sheik and dined with a pasha in the walled city of Fès, the dinner served by Nubian girls jingling with bracelets on arms and ankles.

But the Africa we were to see now was a continent where slaves, camels, and medicine men are disappearing. In their places we found jeeps and trucks, hydroelectric plants.

The Author

The daughter of Alexander Graham Bell, Elsie May Bell Grosvenor grew up in a world of new ideas and expanding geographic frontiers. She was born in London at the time when Dr. Bell was demonstrating his recently invented telephone to Queen Victoria. Her first transatlantic passage came when she was but a few weeks old, on the Bells' return to the United States. She was seven when she was shipwrecked with her family aboard a coastal steamer off Newfoundland. Later she studied in France and Italy, traveled in England and Norway, and in Japan. In 1898, was presented to the Empress.

When Miss Bell was married (1900), her distinguished father was president of the then pioneering National Geographic Society. The year before, her future husband—young Gilbert Grosvenor—had been made editor of its little journal, the NATIONAL GEOGRAPHIC MAGAZINE, and for the next half century and more was to devote his life to furthering The Society's projects and publications.

Mrs. Grosvenor has always taken a deep interest in The Society's activities. She designed its flag, with its stripes of brown, green, and blue, symbolizing earth, sea, and sky. She has read hundreds of manuscripts for The Magazine and examined thousands of pages of proof and tens of thousands of photographs.



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Chiefs of Northern Nigeria Gather at Kaduna for the Opening of Parliament

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Nigeria's new constitution gives its people greater self-rule. In Northern Provinces they exercise it through a House of Chiefs and an elective House of Assembly. Below: Chiefs in robes, turbans, and serras await the session.





✧ The Author, "Window-shopping" in Kano Market, Scans a Display of Kola Nuts

Nigerians chew kola nuts as Americans chew gum. The vendor (seated) spreads his stock on a mat. Wind-borne dust hangs like fog in the distance. A tall Tunreg veils his face, conforming to a male custom of his tribe.



modern hospitals—and, of course, airplanes, which are the real taxicabs of modern Africa.

All night the cold wind howled. When we awoke, we looked out the window at a view as English as it was African. We were in the British official quarter, outside the old walled section of the city of Kano. Its little English gardens and Government-owned houses are neat and modern. The officials are only temporary residents and must move out all their belongings even when going on their biennial vacations. They never know what house they'll come back to, since houses are extremely scarce in Nigeria.

Our pretty young hostess was also English, the daughter of the well-known scientist, Sir John Russell. Before her marriage she had been London editor of the *Junior Britannica*. The Maddockses' extensive library on Africa's birds, animals, and people showed their deep interest in the country Mr. Maddocks helped govern. Their books also helped us identify African birds and beasts we were to see.

As soon as we had finished breakfast, Mr. Grosvenor, Mr. and Mrs. Maddocks, and I started out to explore old Kano. From reading, I knew that its history went back at least a thousand years. It was a caravan crossroads in medieval times and today is still a busy trading center.

Dust Storm from the Desert

As we drove through the city, we got our first taste of the harmattan, the dry, all-enveloping dust-laden wind which sometimes blows in from the Sahara. For the next several days it stung our eyes and faces and gave a weird, unreal effect to everything we saw. Its murky haze colors all my recollections of Kano; it also colored many of the pictures my husband took of the city (pages 147, 149, 153, and 156).

We went through one of the entrances cut in Kano's massive 40-foot-thick mud walls, built centuries ago, and quickly lost ourselves in a maze of winding, narrow streets. More surprising to me were the houses that lined the streets: they were built of mud! They have palm-trunk supports for roofs and doorways. A few were whitewashed or painted; some of the fancier ones were decorated with intricate patterns. Many were getting new layers of mud and native cement.

Spouts of tin or terra cotta jutted like guns from the rooftops.

"They're gutters," explained our sight-seeing host, "to carry off the floods of the rainy season."

"It's the dry time now," he continued, "when careful householders do their repairing and replastering. If they don't get around to it before the rains come, their clay walls will

eventually melt down and they'll find themselves living in a mud puddle!"

We got out of the car at Kano's big, bustling market place and were quickly swallowed up in a noisy crowd. Customers and merchants elbowed each other and us. There were tall, ebony Hausas and lighter Fulani with bearded faces. Everywhere small naked children wandered, along with inquiring goats, donkeys, sheep, and chickens.

Livestock was only part of an amazing variety of merchandise. We saw fine leather goods, metal jewelry, and bright, bizarre prints nudging empty bottles and old razor blades. We also saw—and smelled—dried fish; next to freshly slaughtered meat lay piles of grain, salt, and spices. Kola nuts, chewed for "lift," seemed to be popular (page 147), and so were cosmetics used by local belles to darken their eyelids and henna their nails and hands.

Many of the wares were spread out on the bare ground, with only a thatch or bamboo cover to keep off the sun. Others were displayed in "shops," rows of cavelike mud stalls.

Desert Riders Wear Indigo Cloth

Kano is famous for its cloth, woven of locally grown cotton, and for its brilliant blue dyes brewed from the wild indigo plant. We saw both in the market. In open vats dyers were dipping and rinsing lengths of white cotton cloth which came out in shades of blue from pale to deepest indigo (pages 158, 159). Near by, other workers beat the material to give it a metallic luster.

We saw veiled Tuareg horsemen wearing robes of this deep-blue cloth. Other pieces might add allure to the wardrobes of Kano's harem favorites. Later, in another Nigerian city, I recognized the typical metallic blue in the turbans of prominent native rulers.

We saw almost no women. Kano's ladies are kept well hidden from the profane gaze of outsiders.

Yet change is coming. An elementary school has been established for the long-neglected Moslem girls. It is attended by members of the Emir's own household. The faces of the few women we did see were uncovered, despite the fact that this is a Moslem city.

There was even an ultramodern touch while we were there—a strike by Nigerian railway engineers.

We saw many pyramids at least 30 feet high made entirely of bags of peanuts awaiting transportation south (page 154). They are a leading export of the country; others are tin, palm kernels and palm oil, cocoa, hides and skins. Altogether, Nigeria's exports totaled more than \$350,000,000 in 1951, a foreign trade built up during the last 40 years.

(Text continued on page 154)



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Photography by Gilbert Grosvenor

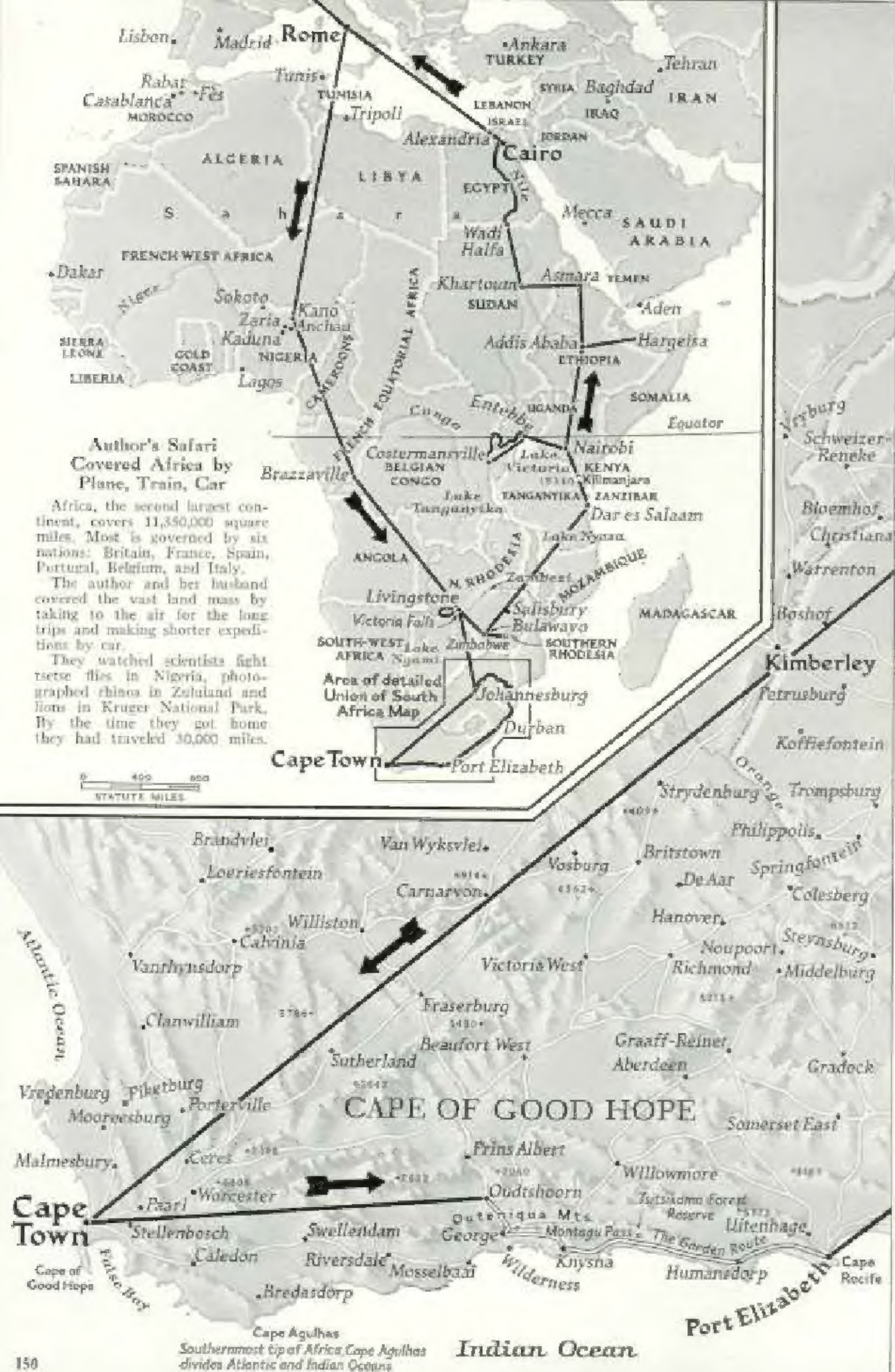
↑ Market-bound Nigerians Enter Kano Through a Massive Adobe Gate

Kano boasts a written history extending back nearly 1,000 years. Today the city is northern Nigeria's metropolis, with 102,000 people. A high mud wall pierced by 15 gates encircles the oldest section. Donkeys and pedestrians, but few vehicles, may use this portal.

✦ Nigeria's Largest Open-air Mart; the Author Shops for Cloth

Sprawling Kano market attracts 20,000 people daily. Merchants, afoot or in stalls of thatch or mud, hawk an infinite variety of wares. The cloth salesman (left) quotes a price in Hausa, his native tongue. The author finds a topcoat comfortable in "tropical" Nigeria.







Author's route
by airplane ——— by automobile ———
0 50 100 150 200
STATUTE MILES
© National Geographic Society

Cape of Good Hope Cape Point
Cape Peninsula separates the cold
Atlantic from warm water of False Bay

Nigerians Say, "Take Our Picture!" Mr. Grosvenor Obliges

For centuries Kano buildings have been made of mud (opposite page). Many, like this dwelling, bear elaborate exterior moulding. Friendly Hausas grouped themselves in front of Mr. Grove's car each time he tried to photograph the geometrical decoration. Not understanding his purpose, they thought it courteous to stop and pose. A thin coating of native cement protects this wall. A solution from pods of the locust bean tree stains and binds the plaster.

Kano Residents, Heavily Robbed Against a Dusty Wind, Stroll Past Mud Dwellings with Weathered Flaking Walls

Home builders in Kano dig soil from near-by "borrow pits" and fashion it into conical bricks. They lay the bricks many layers deep, using palm logs as reinforcement. Mud serves for mortar and plaster. Exteriors, if unprotected by a cement coating, need repair about every three years. These rain-etched walls are beginning to flake, exposing bricks (right). Tin drainage gutters project like guns from the flat roofs. A pile of bricks lies in the street.

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biochemical and molecular biology





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Pennut Pyramids Rise in Kano's Market Place. A Rail Strike Delayed Shipment South

A harvest time journey took us into Kano from a town 100 miles north. We rode two mules to a camel on the way. The camel was a big animal, and the journey was not easy. In the market place many small stalls were set up, and the heavy sacks of cotton were piled up.

From Kano we were scheduled to fly to Zaria, 85 miles to the southwest.

At the airport, "See the sky maiden," we were told.

The pilot, an Englishman, seemed to be a hearty, good natured fellow. He and the West African Airways Corporation were in Kano, and she would be glad to sell us tickets to Zaria or engage a charter plane for us. The only question was: Could the pilot find Zaria? On the trip north that morning the town had been completely hidden by the harmattan mist, and he hadn't been able to land.

We decided to chance it, and our luck held. We flew through and over a dense veil of mist all the way, but when we reached Zaria it cleared enough for us to land.

What Price for the Truth?

"You were lucky to make it," said our host, Mr. Conrad B. Williams, British Resident in Zaria. His wife, an American and from Boston, told us that our trip to the harmattan was really a pretty mild one.

Sometimes the mist is so thick we can't see across the street for the distance. It even blows out to a cloud and covers passing ships.

The ancient Moslem city of Zaria, like so much of Africa, is proud of its modern

facilities. Our hosts showed us a new printing plant which publishes a daily newspaper in the Hausa language. I thought it well printed next to the price, was amazing. It is a "disputable": "The Truth Is Worth More Than a Penny."

We saw a missionary hospital where—a real sign of progress—native women are serving as nurses. They are at their homes to serve as nurses. Founded by the Church Missionary Society and run by a woman doctor, I took a Mr. F. R. C. S., this hospital is rated one of the best in this area.

Nigerians Learn Self-government

But the real event of our visit was the historic meeting in nearby Kaduna, of the first elective parliament in northern Nigeria (page 146). It took place in a shining new white parliament building, Lugard Hall named for Lord Lugard. His article entitled "The New English Province of Northern Nigeria," published in the November 1900 issue of the NATIONAL GEOGRAPHIC MAGAZINE, was one reason for our stopover in this interesting country.

We watched emirs, sultans, and tribal chiefs, dressed in flowing silk and satin robes, take the oath of office and swear fealty to

the British Crown in northern Nigeria's "upper house"—the House of Chiefs. Sir Eric Thompson (famously called "Tombsone"), then Lieutenant Governor of the Northern Provinces, presided over the ceremony from a throne-like chair.

The 1951 constitution provides for northern Nigeria a regional parliament somewhat like England's. The House of Chiefs is roughly equivalent to the House of Lords; the lower, or House of Assembly, members of which were sworn in the following day, is like the House of Commons. Members of the lower House are elected by the Nigerians themselves, except for a few appointed representatives of the British Government in Nigeria.

The congress at Kaduna would pass laws for the Northern Provinces only. Later, like the other two provinces, they would send members to a national House of Representatives at Lagos, the capital of the whole of Nigeria.

In their dress the Nigerian dignitaries far outshone the British at the swearing-in ceremonies. Some of the chiefs' robes were almost blinding—heavily embroidered silk of bright green, white, yellow, blue, or lavender. The chiefs were nearly all tall, striking-looking men, many well over six feet. Most wore enormous turbans of different designs.

Spectacles for Decoration Only

Looking down from the visitors' gallery, I noticed that the chiefs had on huge dark-rimmed spectacles.

"Bad eyes?" I asked Mr. Williams.

"No," he smiled. "These people have superb sight. The glasses are for dignity."

Then I noticed that as each chief went to sign the register, he pushed the glasses up on his forehead and looked under them.

After the ceremony I met the Sultan of Sokoto, head of the Islamic church in Nigeria; also several emirs. As we shook hands, I wondered how long it would be before some of their secluded Moslem women would be permitted to share in the new political freedom.

"Many of the representatives of the lower House are from pagan tribes," Sir Eric said, when we had lunch with him and members of his staff at the British Residency. "There are Moslems, and still others are Christians. One of Nigeria's big problems is this diversity of peoples in religions, customs, and even language."

Since 1946, bitter political rivalry between Moslem and non-Moslem has caused rioting and bloodshed in Nigeria.

In Kaduna we stayed with a brilliant British scientist, Dr. T. A. M. Nash. For 25 years Dr. Nash has been one of the leaders in the fight against Africa's greatest scourge, the

tsetse fly. This small insect, found only in Africa, has devastated vast sections of the continent, for it spreads human and animal forms of the dread disease trypanosomiasis, or sleeping sickness.

For generations sleeping sickness has struck terror across tropical Africa. It has killed hundreds of thousands of Africans and some Europeans, wiped out whole villages, and driven farmers from their land.

Tsetse Fly Blights Vast Areas

Today the fly still blocks progress in an area in Africa bigger than the whole United States. Vast areas of fertile farmland and pastures lie empty and deserted. Though in parts of Africa modern drugs have brought sleeping sickness in humans under control, nagana, an animal form, still destroys livestock and beasts of burden. A cow, an ox, or a horse bitten by an infected fly wastes away and usually dies.

"In Nigeria," Dr. Nash said, "most farmers have to carry their farm produce to market on their heads."

Much of the country's heaviest farm labor, including plowing, hoeing, and hauling, is done by hand, to a large extent women's.

I saw many tsetse flies in Dr. Nash's laboratory, where he breeds them for experimental purposes and to study their habits and find out how best to attack them. They look innocent enough, rather like our own housefly except for their wings, which fold across their backs when at rest. But Dr. Nash keeps them carefully locked up, with metal screens on doors, windows, and cages. These, incidentally, were the only screens we saw in Africa, and they were used to keep flies in, not out.

Tsetse flies are strange insects. They never drink water and live entirely on blood, so that a whole stableful of guinea pigs has to be kept to feed those in the laboratory. The female fly produces only one egg at a time, which she both hatches and nourishes inside her body with milk glands until it is born.

Mother Tsetse's "Babies" Born Alive

The mother tsetse fly gives birth to a tiny white larva much as a woman gives birth to a baby.

The larva immediately buries itself an inch or more under the ground, where it turns into a pupa (chrysalis) and some weeks later into a fly.

One mating suffices the female for life. Starting about 20 days after mating, she produces one such larva every 10 days during her life span, usually about three months.

The young tsetse fly is not harmful at first. Not until it bites an infected person or animal does it pick up trypanosomes, the parasites



A Girls Let Shopping Go to Their Heads

As the clock is turned to 12:00, the two clocks are set to 12:00 as they are with the fixed point in a product of the plane. The two points are connected by a line segment of length 1. The two points are connected by a line segment of length 1.

* Big or Small, Your Pay Size Is Here

[illegible]

that cause sleeping sickness. But from then on it is dangerous as long as it lives.

There are 11 different varieties or species of tsetse fly in Nigeria; some feed chiefly on men, and other varieties prefer animals.

The tsetse fly has a sharp proboscis, resembling a tiny hypodermic needle, projecting straight out from its head. When the fly alights on a man, this proboscis pierces the skin, injects a non-blood-clotting substance, and then draws blood. At the same time it may deposit trypanosomes in the bloodstream.

Dr. Nash, who still is young and energetic after 23 years of battle against the fly, told us about the work he and other scientists are doing to bring it under control.

One weakness of some species of tsetse fly, he explained, is that they must have shade. They breed and live in thick undergrowth. Back in the 1930's Dr. Nash's research showed that by clearing only the undergrowth and bushes along streams the riverine tsetse could be eliminated. This partial clearing method was then employed on a large scale in the Anchar district. In a report on the project Dr. Nash wrote:

Attention was first focused on the Anchar district of Zaria Province in 1934, when Dr. N. E. W. Anderson found that one-third of the population had sleeping sickness and that in some hamlets half the population were infected."

Today the cleared area is a corridor in northern Nigeria 70 miles long and 10 miles wide. Here 60,000 people and their livestock live, healthy and fly-free. Old Anchar, the region's chief city, has been cleaned up, and new villages have been built.

How to Move a Spirit

With dry humor Dr. Nash tells some of the difficulties of this 10-year clearing and rebuilding job.

"When we first started clearing around Anchar, the presence of sacred trees in the streams caused much trouble, especially in one village area. The village head would suddenly give out that the work was reaching a place where any man would die who entered the grove; the labour gangs would not turn up next day and work would come to a standstill.

"The following method soon abated this nuisance. The village head, who was also the earthly leader of the spirit world, would be interviewed in front of all his people, and after much preamble told that the existence of these spirits was causing us much trouble, that unfortunately Europeans were quite incapable of making spirits change their abodes but that it was rumoured that he had this amazing power: we could not believe it possible for any man to do such a thing, and con-

sidered it to be all lies, but, if he really had these powers, would he kindly remove the spirits on to a neighbouring hill.

"Invariably the old man would turn up next day saying that he had wrestled with the spirits all night, and that finally they had agreed to live on the desired hill. Everyone was happy; the old man's prestige was enhanced, and we got the streams cleared."

Eventually the work grew into far more than clearing and insect extermination. As tribesmen were resettled in cleared areas, whole new communities had to be planned from the ground up. Dr. Nash describes the new village of Takalaŋya near Anchar:

"The roadways, all 100 feet wide, act as firebreaks, for which there is a great need.

Pink Flowers and Pure Water

"All the roads in Takalaŋya have been planted up with avenues of mahogany, mangoes, figs, and the pink-flowered Cassia; a regular spacing rate of 75 feet has been used in laying out the avenues . . ."

Careful planning also went into locating and digging sanitary fresh-water wells and in providing drainage and elementary sewage disposal. A new elementary school has been built, and a 12-acre model farm demonstrates new methods and new crops, including soybeans and fruits.

Appropriately, the town's name, Takalaŋya, means "Walk in Health."

But Africans will not walk surely in health until some way has been found to control nagana in broader areas. New medicines are being tried against the trypanosomes themselves. Cattle in the tsetse belt are being given injections of antivenal. But, so far, it has provided only a short-term immunity.*

The biggest reservoirs of nagana parasites left in Africa now are wild animals in the jungle. Many of them are tolerant to the disease but carry the parasites in their blood, like "Typhoid Mary." The tsetse fly bites one of them, picks up the parasites, and is dangerous from then on.

Dr. Nash told us that in certain limited areas where it is essential to reclaim land from the woodland tsetse for increasing herds of cattle, a policy of game destruction is advocated because these tsetse disappear if there is no game.

"Such a measure naturally brings a storm of opposition from conservationists, naturalists, hunters, and many others," he said, "but in such circumstances on ethical grounds man must come first."

One of the pleasantest hours I passed in

* See "Britain Tackles the East African Mosh" by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, March, 1957.



a "Tubey, as for Cigarettes Pao, Kuo, Guineen Dye Cloth and Sakers of Yarn in Lurken Vase Piled w/ Tobacco

$$\begin{aligned} \Gamma_1 &= \omega_1 \otimes \omega_2 \otimes \omega_3 \otimes \omega_4 \otimes \omega_5 \otimes \omega_6 \otimes \omega_7 \otimes \omega_8 \otimes \omega_9 \otimes \omega_{10} \otimes \omega_{11} \otimes \omega_{12} \otimes \omega_{13} \otimes \omega_{14} \otimes \omega_{15} \otimes \omega_{16} \otimes \omega_{17} \otimes \omega_{18} \otimes \omega_{19} \otimes \omega_{20} \\ &= \omega_1 \otimes \omega_2 \otimes \omega_3 \otimes \omega_4 \otimes \omega_5 \otimes \omega_6 \otimes \omega_7 \otimes \omega_8 \otimes \omega_9 \otimes \omega_{10} \otimes \omega_{11} \otimes \omega_{12} \otimes \omega_{13} \otimes \omega_{14} \otimes \omega_{15} \otimes \omega_{16} \otimes \omega_{17} \otimes \omega_{18} \otimes \omega_{19} \otimes \omega_{20} \\ &= \omega_1 \otimes \omega_2 \otimes \omega_3 \otimes \omega_4 \otimes \omega_5 \otimes \omega_6 \otimes \omega_7 \otimes \omega_8 \otimes \omega_9 \otimes \omega_{10} \otimes \omega_{11} \otimes \omega_{12} \otimes \omega_{13} \otimes \omega_{14} \otimes \omega_{15} \otimes \omega_{16} \otimes \omega_{17} \otimes \omega_{18} \otimes \omega_{19} \otimes \omega_{20} \\ &= \omega_1 \otimes \omega_2 \otimes \omega_3 \otimes \omega_4 \otimes \omega_5 \otimes \omega_6 \otimes \omega_7 \otimes \omega_8 \otimes \omega_9 \otimes \omega_{10} \otimes \omega_{11} \otimes \omega_{12} \otimes \omega_{13} \otimes \omega_{14} \otimes \omega_{15} \otimes \omega_{16} \otimes \omega_{17} \otimes \omega_{18} \otimes \omega_{19} \otimes \omega_{20} \end{aligned}$$
[illegible]



Africa was on Sunday morning in Karluna. With Dr. Nash we went to a little Anglican church which has been put up by the English people of the community.

The church is built without side walls, so that it is almost completely open to the surrounding trees. From the sunlit green branches outside came a chorus of bird songs so loud and clear it all but drowned out the words of the service. There were larks, nightingales, and many more, as sweet and melodious a choir as I have ever heard.

Skyscrapers Built on Gold

Three thousand miles southeast of medieval Kano lies Johannesburg, a modern city built on the profits from the Union of South Africa's fabulous gold mines. In a swift British plane we covered the distance in 15 hours, stopping only twice.

We touched first at Brazzaville, the sultry capital of French Equatorial Africa, and, during World War II, headquarters for the Free French. At Livingstone, in Northern Rhodesia, we landed again, this time in a tropical downpour. We flew on in a storm that tossed our big plane as if it had been a small boat.

On the long drive to town from the Johannesburg airport we frequently passed great pyramids of earth rising from the ground. The man-made mountains are the gold mine dumps that are Johannesburg's trademark. Less than 70 years ago neither they nor the city existed. There was only a treeless veld here in 1886, when the world's richest gold lode was opened.

Since then both trees and cities have sprung up along the whole 150-mile stretch of the treasure-bearing Witwatersrand, "Ridge of White Waters." Mines with local headquarters in Johannesburg produced about \$409,300,000 worth of gold in 1952.*

Johannesburg is now third only to Cairo and Alexandria among Africa's cities and is the largest south of the Sahara. Its streets are lined with skyscraper offices, streamliner apartment buildings, and luxury hotels. Prosperous mining companies and world-famous banks alternate with smart shops, theaters, and cafes. Nearly a million people now live in Johannesburg, and it is still growing.

Johannesburg, or "Jo'burg," as the South Africans call it, looks and feels youthful. Trees line its avenues; its suburbs bloom with flowers. Its 5,800-foot elevation makes the air seem clear and bracing, the sunlight sparkling.

Yet the city reaches farther down than it does up. Three gold mines inside Johannesburg's municipal area go more than 2,000 feet below the surface. Only the most modern scientific techniques and air cooling make it possible for men to work so deep underground.

Johannesburg's gold has produced more than skyscrapers and modern machinery. Four thousand students at the new University of the Witwatersrand are taking courses in the arts and sciences, medicine, postgraduate law and engineering. The university was opened only a little more than half a century ago as a technical school.

We ate a pleasant lunch with the university's president, Dr. Humphrey R. Raikes, and Dr. John H. Wellington, dean of the faculty of Science and professor of geography, on the terrace of the Country Club. Dr. Wellington had visited the National Geographic Society in Washington, D. C., several months earlier. Dr. Raikes, in addition to his work as a scientist, distinguished himself in the RAF during World War I; later he became chief instructor of the Oxford University Air Squadron.

During lunch we enjoyed the beautiful view from the terrace almost as much as the food. Next we were shown through the Witwatersrand Library.

We saw a fascinating collection of maps, diaries, and other documents all dealing with the opening up of Africa. And again I was struck by the newness of this country we were visiting. Some of the papers, telling of expeditions into wild and unknown regions around Lake Ngami and the Zambezi River, were signed by David Livingstone.

"You can see how recent these discoveries were," said our host, pointing to another of the signatures. "This man was my grand father."

Stone Cross Marks Landing by Dias

The library's prize possession is a great deal older. It is a 7-foot stone cross raised in 1488 by the Portuguese explorer Bartholomew Dias on the southeast coast of Africa.

Dias, looking for a passage to India, was the first European to sail around the tip of the continent. He never got to India. His men rebelled and forced him to turn back; so, as evidence that he had gone this far, he landed and raised the cross.

"For centuries Portuguese writers mentioned the Dias cross," Dr. Raikes told us. "Then it was heard of no more. Not until 1938 did it come to light again. One of our research fellows found its fragments buried in the sands 40 miles northeast of Port Elizabeth. It was brought here and pieced together."

Three and a half centuries passed between Dias's first landing and the opening up of the southern part of Africa.

* See "The Cities That Gold and Diamonds Built" by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, December, 1947.

(Text continued on page 177)



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4. Lions Use the Path of the Author's Car in Kruger National Park

When I was in Kruger National Park, I saw a lioness walking along the path of my car. She was looking at me and I was looking at her. She was walking towards me and I was walking away from her. She was walking on the path and I was walking on the path. She was walking on the path and I was walking on the path.

5. Lion Walks Away with Royal Dignity - His Beard Is Too Long to Move

When I was in Kruger National Park, I saw a lion walking away from me. He was walking with a royal dignity. His beard was too long to move. He was walking away from me and I was walking away from him. He was walking away from me and I was walking away from him.





Clouds Clear from Bay of Chiloé to South Africa's Table Mountain: Cape Town lies at its base.

The African Table Mountain, which is a prominent landmark in the Cape Town area, is visible in the distance. The image captures a wide view of the bay and the surrounding landscape, with the clouds clearing to reveal the distant mountains.



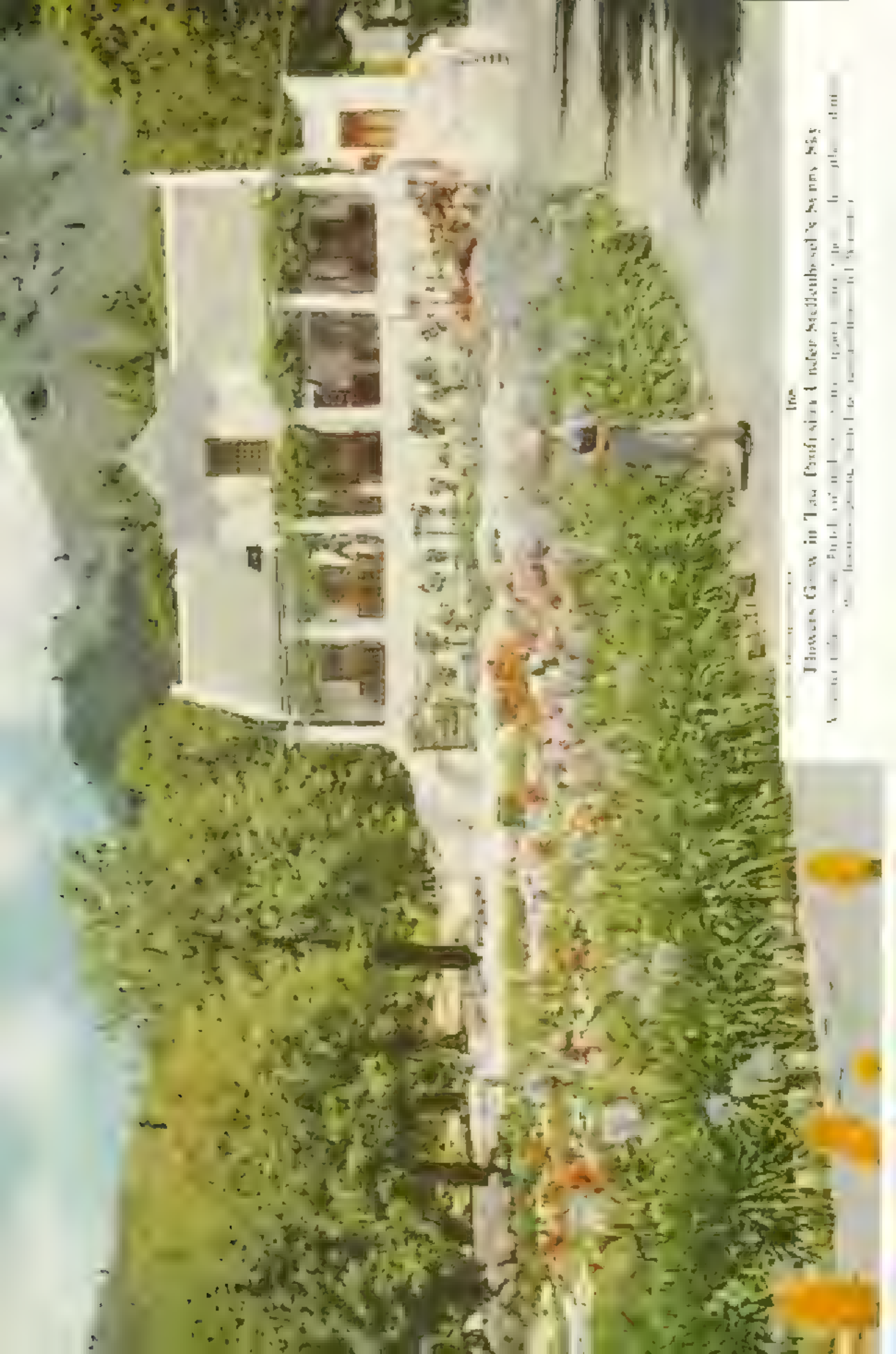


Vacationers Bathe in the Surf or Stroll Beneath a Cloudy Sky

Figure 3.00: A vintage color illustration of a beach scene. In the foreground, a large yellow and blue striped beach umbrella is open on the sand. To its left, a man in a white shirt and tan pants stands near a woman in a light blue dress. To the right, a man in a white shirt and dark shorts stands. In the middle ground, a woman in a green and white striped dress is walking. Further back, a man and a woman are walking together. The background shows the ocean with white surf and a hazy, mountainous coastline under a cloudy sky.



Table Mountain Rising Like a Weathered Fortress Above South Africa's Houses of Parliament at Cape Town



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Flowers grow in the garden and near the entrance to the house.

A large number of flowers are in bloom in the garden and near the entrance to the house.

Young Zulu Men with Pellets as they Spin the Xhosa Hair of Cows near a Roundabout Village in Natal

Fig. 7. Young Zulu Men with Pellets as they Spin the Xhosa Hair of Cows near a Roundabout Village in Natal. The young men are spinning the hair of cows into pellets. The pellets are used for making beads. The young men are standing in a line, each with a spinning wheel. The spinning wheel is made of wood and has a large wheel and a small wheel. The young men are using their hands to spin the hair. The pellets are small and round. The young men are wearing traditional Zulu clothing. The background shows a roundabout village in Natal.











Natural Barriers of Wave-battered Rock Divide the Suburb's Bathing Beaches

A line of wave-battered rocks, some of them as high as a two-story house, divides the suburb's bathing beaches into a series of small, sheltered coves. The rocks are scattered along the shore, creating a natural barrier between the open ocean and the beach.



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Lion's Head Caps the Bald Summit of a Rocky Hill Above Sea Point

Sea Point is a charming little town on the coast of South Africa, and the view from the Lion's Head is a most beautiful one. The Lion's Head is a rocky hill, and the view from the top is a most beautiful one. The Lion's Head is a rocky hill, and the view from the top is a most beautiful one. The Lion's Head is a rocky hill, and the view from the top is a most beautiful one.

"Don't fly down to Cape Town," a fellow passenger warned us at Johannesburg. "It's a really rugged trip." In this southwest corner of Africa, he explained, cold and warm air come together violently; storms are frequent, and landing over Table Mountain is dangerous.

But to us it sounded even more "rugged" by train—28 hours and almost 1,000 miles over a torrid, semiarid mountain country. The plane trip, however lumpy, would be over in three hours. We decided to risk it, and, as it so often turns out, the passage was less rough than the warnings.

My first view of Cape Town from the air was worth the trip to me. Set close to the sea, the city seems to flow in red and white waves up and around the mountains behind it—Devil's Peak, Lion's Head, and the massive Table Mountain (pages 162, 166).*

Wispes of cloud floated over Table Mountain's broad flat top. Cape Towners call this the "tablecloth;" when a blustery southeaster blows this way, the cloud completely covers the surface of the table.

We found Cape Town in full bloom, for January, of course, is summer in this Southern Hemisphere. Parks and gardens were gay with blossoming trees and rainbow-colored African flowers (page 168).

Our suburban hotel was perched high on a cliff, overlooking the Atlantic where Dias once sailed. At dusk we climbed down a winding stairway—so many steps!—to the amble-strewn beach below. Charming bungalows face the sea, their rock-garden terraces overgrown with geraniums, nasturtiums, and pinks. In the background, as unreal as a post card, towers the great sharp peak of Lion's Head and the range of the Twelve Apostles (page 174).

Where Mighty Oceans Meet

Pleasant homes like these, lovely resorts, and fishing villages line all the miles of beaches on Africa's southern peninsula, ending in the famous Cape of Good Hope and Cape Point (page 181).

Most of the resorts and fishing villages lie on the protected east coast, facing False Bay, which is near the Indian Ocean side. There the water is warmed by the tropical Agulhas Current. On the Atlantic side the cold Benguela Current chills the beaches.

Not far from our hotel we came to a huge swimming pool built along the very edge of the open ocean.

"It's not only rough and cold out there," a Cape Town resident told me, pointing toward the sea, "but you're likely to meet a shark."

Cape Town is the oldest important permanent white settlement in Africa south of the

Equator. While we were there, the city was getting ready a big exposition ground to celebrate its 300th birthday. It was founded by the Dutch East India Company some 50 years after the Dutch West India Company had sent settlers to New Amsterdam and bought Manhattan from the Indians.

When you talk to Cape Towners about history, you hear again the name of Dias. They tell you about East Indiansmen that sailed around the Cape for 160 years after Dias, their crews in too much of a hurry to get to the Orient, or home again, to stop here. Once in a while a vessel would pause briefly for water.

Then, in 1647, a Dutch ship was wrecked, and the survivors scrambled ashore at what is now Table Bay. From a salvaged packet of seeds they grew vegetables to keep themselves alive till rescue came.

From a Seed Packet, a City

The incident gave the Dutch East India Company an idea. In April, 1652, a company surgeon, Jan van Riebeeck, was landed at the site with about 100 settlers. His orders were to plant a vegetable garden for the benefit of the starry-tided seamen of the East Indies traffic.

From the sailors' "Tavern of the Sins" Cape Town grew into one of the world's famous ports. Today it is the capital of Cape of Good Hope Province and the legislative seat of the independent British Dominion, the Union of South Africa.

In the heart of town, now numbering half a million, the stately Houses of Parliament face the 12-acre Public Gardens (page 166). And where Van Riebeeck's vegetables once grew, I saw a show collection of thousands of varieties of flowers, shrubs, and trees from all over the world.

Among them are many species of Australian eucalyptus and wattle, tried out as part of South Africa's extensive forest-planting program. "First thing you know, we'll have more Australian trees in South Africa than they have in Australia," a Cape Towner laughed.

"We make mine props out of eucalyptus," he added, "and the wattle bark supports our big tanning business."

But if South Africa imports some of her trees, she more than pays for them with the native flowers she exports. So abundant and beautiful are the Cape Province's wild flowers that the area has been called "the floral province." Flowers originally native to South Africa are now cultivated in gardens all over the world. Among them are some of the live-

* See "Busy Corner: the Cape of Good Hope," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, August, 1932.

lunch, tea at 4 o'clock—tea, tea everywhere! Fortunately, we like tea.

In the east and north of Cape Town the English influence is less dominant, giving place to Dutch and French. This is wine country. Here the mountain slopes and fertile valleys are covered with vineyards, and some of the wines are world famous.

Land of Vineyards, Mountains

The Dutch settled here in the 1680's and found the rolling sunlit countryside ideal for growing grapes. A little later an influx of French Huguenots added their centuries-old wine-making skill.

Paarl is the center of today's wine and brandy industry. A hospitable town, it drowsed in the sun as we drove along its 7-mile "Main Street." Despite the Dutch name, the whitewashed walls, tall, pointed cypresses, and talk of grapes and vintages made me think of southern France.

The first important vineyards in the area were planted by Simon van der Stel, one of the pioneer Dutch governors. We visited his home, Groot Constantia, which has been restored as a museum. It is a cool, white mansion with curved and curled Cape Dutch gables shaded by stately old oaks.

In the rear of the house we saw dark, cave-like rooms without windows, once used as slave quarters. Here the slaves were locked up at night. Near by ran a stream where they washed their feet when it came time to trample out the grapes.

Van der Stel's vineyards are still producing. The South African Government now operates the Groot Constantia homestead as a model wine-making center.

Another monument to Van der Stel is the near-by city of Stellenbosch, which he founded in 1679. From the University of Stellenbosch, center of Afrikaans speech and culture, have come three South African Prime Ministers, including the late Jan Christiaan Smuts.

Sight-seeing trips around the Cape Peninsula may turn up anything from granite temples to mischievous baboons.

The Temple on Devil's Peak

Skirting Devil's Peak, we drove south through land once owned by Britain's empire builder, Cecil Rhodes. He left a huge estate to the country he helped found. His own house, Groote Schuur, he bequeathed as the official residence of prime ministers of the then unborn Union of South Africa (page 178).

On the slopes of Devil's Peak above Groote Schuur the South African Government has built an impressive temple in his memory. Near by stands the University of Cape Town, housed in white classic buildings.

At the university we picked up a professor who was to show us a bird sanctuary in Cape Flats, a watery area north of False Bay.

On the way we had our first look at a South African bird that was to become very familiar—the tickbird, or cattle egret. It was perched on a cow, searching for ticks and other insects scared up as the animal walked along. Within the past year cattle egrets have been found in Florida and north to Cape May, New Jersey, and even New England.

The sanctuary is called Sencoo by the English, from the Dutch word *zeekoe*, which means "sea cow." The name goes back to a time when hippopotamuses (sometimes referred to by older South Africans as "sea cows") cooled themselves in its waters.

The hippos have long since been killed off, but we found the low, marshy land and cloudless sky dark with birds—pelicans (white with black wing tips), herons, gulls, terns, and egrets. There were ponds, swamps, storks (both black and white), and many kinds of ducks and plover, as well as the swallows which we were to find all over Africa.

We were fascinated by the show, since for 40 years we have made our home outside Washington a sanctuary for North American birds.

We recognized one of the Sencoo visitors, the arctic tern, as an old friend and world traveler. Every year this bird flies from the tip of Africa and other southern areas to eastern Canada and greets us at our summer home at Baddeck, Nova Scotia. Its route, almost 11,000 miles, is the longest of any migratory bird.

Beware the "Friendly" Baboons

At the end of the spectacular Marine Drive, cut in spots through solid rock high above the breakers, we came to the Cape of Good Hope. There, on the great barren rocks that plunge 650 feet into the sea, a band of baboons, the "Cape clowns," stood between us and the open ocean. There were big, medium-sized, and little baboons, and some tiny ones clinging to their mothers.

They were curious and seemed friendly and even approached us to beg for food. But they are pranksters, and we were warned not to leave the car without closing the windows.

Not long before, baboons had torn the upholstery of an open car to bits.

Early one morning we flew from Cape Town to Oudtshoorn, center of the ostrich-raising industry. What gold is to Johannesburg, the ostrich is to this dry inland region. Before World War I, when the demand for plumes was at peak, this section of the Cape Province was known around the world.

Then Paris modistes decreed hats without

plumes. The bottom dropped out of the market and fortunes were lost, until Outshoorn's ostrich breeders learned to supplement their leather business with other activities—dairying, farming, and sheep raising.

Ostriches provide more than feathers, however. For morning tea under shady pepper trees at one ostrich farm, I tried ostrich meat *à l'œuvres*, a form of billing, grated and served on crackers. It was dark brown, crisp, salty, and slightly sandy.

One Egg Serves 24 People

For lunch we ate ostrich-egg omelet. Ostrich eggs are much richer than hens' eggs, but they provide the perfect answer in case of unexpected guests: one ostrich egg can serve 18 to 24 people!

We use just about everything, from feathers to toenails," said our hostess. "The toenails and sometimes the feet are made into ashtrays. Even the skin makes excellent handbags and shoes. But only the males—and the best breeds—give us the valuable black and white plumes for capes, fans, and hats. The females' feathers are dull gray. We make dusters out of them."

There are now an estimated 25,000 birds on about 200 farms in the Outshoorn area. Dry, sunny conditions there and even for the ostriches to race about particularly favor the industry. But there are many tricks to this trade.

Ostriches can be annoying, undependable creatures. Mortality is high among the chicks, and adults tend to have accidents; they try to eat the inedible or they fall into holes and break their legs.

Ostriches do not mate until they are three or four years old. Incubation of eggs lasts six weeks. During this time the cock takes turns with the hen in sitting on the nest.

We saw hundreds of baby ostriches about the size of turkeys. Different age groups are kept in separate enclosures for the protection of the smaller ones.

When the time comes for plucking, farmers pull the big birds by their necks into a pen with a shepherd's crook. Extreme care must be taken to keep from breaking the ostrich's delicate neck. During the plucking process a cover is often slipped over the bird's head.

"No," someone answered my question. "It doesn't hurt the ostrich to pick his feathers any more than it does a man to get a haircut."

Though ostriches can't fly, they make good speed on the ground. They sometimes race around the corral at 25 miles an hour or more.

Teased into dancing and flapping their stubby wings, they make a comic sight. But adult cock ostriches are far from harmless.

One we watched was particularly nervous and belaguered. When an attendant passed at him, he struck out suddenly with his powerful legs.

"They've been known to rip a man open with those heavy nails," the farm manager told us.

I noticed a man riding an ostrich around the corral.

"It's not hard," they told me. "Try it."

Climbing up on my steed, I found it rather precarious with nothing to hold to but a handful of stuff (page 171).

On the other hand, it's something of an experience to pluck feathers (my haul was two handsome feathers, one black and one white) from one's mount.

Between Outshoorn's desertlike country and the lush coastlands along the Indian Ocean rise the Outeniqua Mountains. Outeniqua means, in Hottentot language, "Little Brown Man Who Brings Honey from the Mountains."

Across the high, narrow passes of this range many of the Boer pioneers managed somehow to drive their ox teams and heavily laden wagons into the open veld beyond. Like America's western settlers, these Voortrekkers endured great hardships in their search for land and freedom. Their daring was rivaled only by that of the engineers who later built magnificent highways over these same narrow passes.

Driving south, in a series of awesome turns and twists over Montagu Pass (page 186), we left the arid hinterlands behind to follow South Africa's "Garden Route."

This lovely stretch of coastal roads winds between the mountains and the sea. Here deep-green forests alternate with fields and gardens. Thousands of varieties of flowers and flowering shrubs line the way.

Farther along come panoramas of seaside cliffs, white beaches and blue lagoons, and ocean-fronting resorts, with bowling greens, golf courses, and tennis courts.

Many owners, retired Englishmen, and vacationists from the warmer African regions flock to the garden playground. We stopped at land's end, in the popular scenic resort hotel incongruously called "Widerrass."

The Rondavel—Africa's Motor Court

The proprietor, Mr. Owen Grant, has been a member of the National Geographic Society for 26 years. He came to South Africa from England in 1900 and was one of the engineers who helped build the country's mountain-climbing railways. He was a pilot in World War I and still flies his own plane. When he visited New York several years ago, he rented a small airplane to fly himself and Mrs. Grant around the eastern States.

While my husband played golf with him on



Cape Point's Rocky Finger Marked Vasco du Gama's Passage to India

At the tip of the Cape Peninsula below the Castle of Good Hope, the Atlantic Ocean is a warm, sun-drenched bay. Warmth by a constant trade wind, the sun, and the bay's shelter from the cold Atlantic, could even here

at a distance near Africa's tip, I went swimming in the warm Indian Ocean with Mrs. Gama. And it was at Wilderness that we met our first African rhinoceros.

This is not some strange wild beast but a small guesthouse, built in the circular shape of a native hut (since 1981). Luxury roadways with fine furnishings, electricity, and running water, rank with the best U. S. southern resorts. South Africa has its share of these, too.

Through Vast Primeval Forests

On the Garden Route nearer to Port Elizabeth we drove all day through vast forest preserves. Some were stands of eucalyptus trees; others were the highly prized stinkwood and South African yellowwood. The city of Knysna, on the edge of the forest, is a busy timbering center.

In the mossy, dark green depths of the woods we saw some of the largest elephants in the world. Only a remnant of the once mighty herd remains.

We saw 10 elephants. But in the near-by

forest we found the famous King Edward IV tree. It is a native South African yew, some 137 feet tall. Its age is estimated at between 15 and 17 centuries—surely one of the oldest living things in South Africa.

Fort Elizabeth, 25 miles to the east, was named for the wife of an early British governor of the Cape colony, Sir Rufane Donkin. Lady Donkin died in India without ever seeing Africa. After her husband had returned to Africa in 1800, he had a small monument raised on a hill near the fort.

"To the memory of one of the most perfect of human beings..." says the bronze plaque. Elizabeth Frances, Lady Donkin, died in the Upper Hindustan of a fever on 23rd August 1805, aged 36 years. Sir Rufane Donkin was never married but young to her the day after he had sustained and a man and woman were still young to her. He erected this pyramid.

The monument is a small, last-growing monument to the memory of the woman who has



A Wary Kooka Stands

Paused for a Moment in

Yellow Gum Reserve

In the South Sydney Council
 Park, a Kooka stands
 on the edge of the reserve,
 looking out over the city.
 The Kooka is a native
 animal, and it is not
 uncommon to see one
 in the park. It is a
 shy animal, and it is
 not easy to approach
 it. It is a beautiful
 animal, and it is a
 shame that it is so
 shy.

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shame that it is so

shy.

The Kooka is a native

animal, and it is not



of new industries, but shipping is the big business; it is South Africa's third largest port. Canned pineapple from here finds its way to the grocery store in our Nova Scotia summer home.

Along this coast, as in the West Indies, hopeful fortune-seekers are always fitting out expeditions to find lost treasure. Our morning paper told of a venture just getting under way between Port Elizabeth and Durban. Its object was to bring up gold from the East Indiaman, the *Grosvener*, wrecked in 1782.

It would be well worth salvaging! The 800-ton *Grosvener* sailed from Trincomalee, Ceylon, in January. Boarded was a fabulous treasure: gold, silver, ivory, precious stones, and coins, valued then at \$10,000,000. Besides these, the ship also may have carried two jewel-encrusted golden peacocks from the throne of the Great Mogul at New Delhi. The throne was once valued at \$35,000,000.

So loaded, the *Grosvener*, a floating treasure chest, ran into bad weather off Pondoland, about 30 miles northeast of what is now Port St. Johns. Wedged in rocks only a few hundred yards offshore, she was broken up by heavy seas.

Since then, several attempts have been made to rescue the treasure. One group in 1906 tunneled under the sea bed to within 40 feet of the wreck, then quit for lack of capital. So far, only a few coins, some broken china, and some rusted guns have ever been found.

"Thanks to Mr. Bell"

Even more of a surprise than the story about the *Grosvener* was another newspaper headline: "Thanks to Mr. Bell." By coincidence we had arrived just as the city was inaugurating a new automatic telephone exchange, to serve 3,000 new subscribers.

The "thanks" referred to my father's invention of the telephone 76 years earlier. With it was a page-long and unusually accurate biographical sketch.

My husband and I visited the editorial offices of the newspaper, the *Eastern Province Herald*, to thank its editors. It was mid-morning when we arrived, and we found them

of course! Having tea. After introductions they asked us to join them. The next day the *Herald* had another story with a picture and a three-column headline:

"P. E. Telephone Switch Coincidence: Inventor Bell's Daughter in City!"

But if dial telephones symbolize modern Africa, one sight I saw in Port Elizabeth was straight from the jungle. In the heart of town lies a shrub- and plant-filled pit where hundreds of live snakes writhe and crawl, coil and uncoil. We watched Johannes, a Zulu native attendant, dressed in heavy

gloves and leggings, handle the puff adders, Cape calras, boomslangs, green and black mambas, and other venomous snakes.

A job in Snake Park is not for the timid. Johannes and other men who go into the pit are often bitten. They survive only because of snakebite serum, quickly administered.

We had visited "snake parks" in other cities, including the famous ones in São Paulo, Brazil, and Miami, Florida. They are more than just tourist attractions. Port Elizabeth's reptiles are regularly "milked" of their poison for use in making antivenins. During World War II the serpentarium collected venom for serum to protect the lives of Allied soldiers.

Durban: Lonely Outpost to World Port

We flew next to Durban, South Africa's leading seaport, with a population of 475,000. It has many factories, and its wharves are busy and crowded; yet it has beautiful resort hotels along its water front, fine, clean beaches, and a wonderful warm sea wind.

Only 125 years ago it was a lonely British outpost. The land around it then was still ruled by Zulu kings whose fierce warriors, thousands strong, had fought bloody battles with the early settlers.

Here the South African street scene, familiar to me by now, changes. Small-featured Indian women walk by in gold and lavender saris. Exploring side lanes, I found descendants of Zulu warriors selling magic potions and charms along with medicines—native even.

In a shed market we saw samples of the old Zulu crafts—beadwork, feathers, and basket weaving. Next to them were delicate ivory carvings made by the Indians, relative newcomers to Africa (page 190).

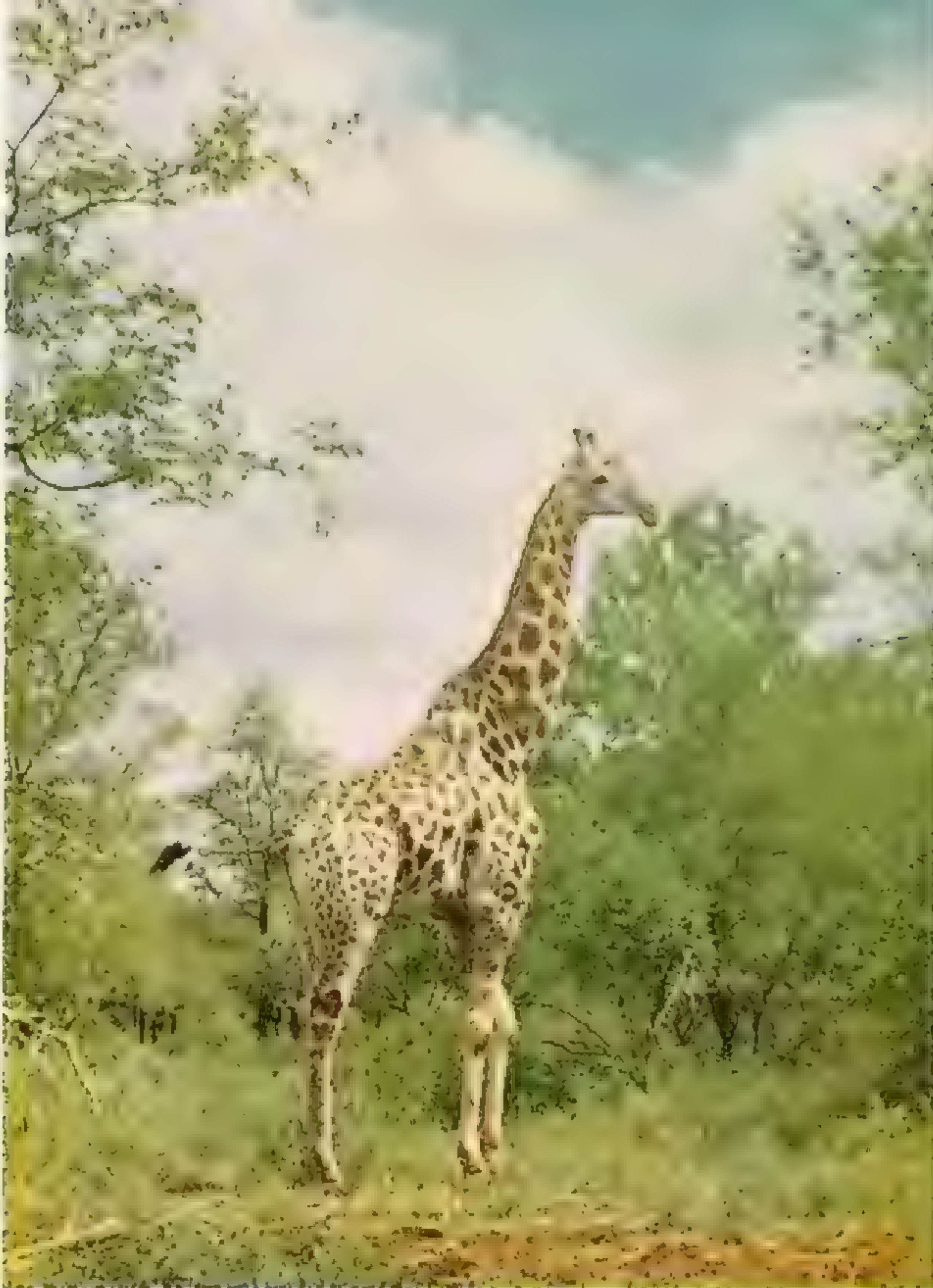
"We have the largest Indian community of any city outside India," a Durbanite told us. "It started in the 1860's, when the sugar growers began importing indentured workers from India for their plantations. Now we have Hindu temples, bazaars, and even fire walkers and snake charmers."

Substitute for Witch Doctors

In Durban we visited the McCord Zulu Hospital, one of South Africa's first hospitals exclusively for non-European patients.

Its founder was Dr. James B. McCord, an American medical missionary who came to Natal in 1899. The Zulus, when he arrived, still depended on witch doctors to cure their ills. Dr. McCord devoted the next 40 years to bringing them modern medical care.

Dr. Alan Taylor, who has headed the hospital since Dr. McCord retired in 1940, and Mrs. Taylor, who is a Canadian, proudly showed us through the modern 6-story wing from a cottage clinic where Dr. McCord once



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Photo by H. S. Gentry

Bull Giraffe Takes a Lofty View from a Roadside in Kruger Park

While on the road in 1936, the giraffe, of the "bull" variety, was seen by the author and his party. The animal was first seen and then the author and his party were seen by the giraffe. The giraffe was seen from the road and the author and his party were seen by the giraffe.



Mountain Highways Cut Through Mountains, Fronteers Crossed in Days

U.S. and Mexican Air Force officials reported that the aircraft was shot down in the Gulf of Mexico, 100 miles off the coast of Mexico. The plane was carrying 100 passengers and crew. The wreckage was found in the Gulf of Mexico, 100 miles off the coast of Mexico. The plane was carrying 100 passengers and crew. The wreckage was found in the Gulf of Mexico, 100 miles off the coast of Mexico.

Students will be able to demonstrate an understanding of a
 lesson plan and lesson objectives - well-equipped
 to be able to do this by the end of the lesson, native
 and white.

One of Dr. Macdonald's problems, especially in the early years, was the great diversity of native dialects, which he had to cope with throughout his life in Africa. His nurses, for example, to care for all of their patients, had to know not only English but six different dialects spoken within 100 miles of Durban.

Everywhere we went, from the children's ward to the verandas, where men lay on the low Zulu style patterned cushions listened eagerly to Dr. and Mrs. Taylor's words.

"We accept not only Zulus," he told us, "but Indians and all other non-Europeans we can find room for. Not long ago the Dutchman Indians themselves collected funds for a Mahatma Gandhi Ward."

South Africa's Own Paul Revere

Twenty years before the first Iniquus came, the fate of the infant part of Durban hung in the balance. It was decided by an English Paul Revere.

We heard the story out at the city's Old

Port. Here, at which time a number of new
and improved gardens, the first set out
military camp in 1842.

At this juncture, with the assistance of Dick, who had received instructions from the headquarters at Uteemmaruk, the Danish sergeant, the British garrison was successfully withdrawn to the English cutter at the port. Young Dick King, volunteered to ride for reinforcements.

His goal was Grahamstown wh. 800 miles away over the tortuous mountain and river trails of his time. Despite hostile natives, wild animals, and crocodile-infested rivers, he reached it in 1820. & Mbaraka was there for the British, who pay their respect to him and his house in an important shrine on the cape peninsula.

Atoring Island to Pietermaritzburg, now capital of Natal, we found the Dutch side of the struggle. The city itself is named for two stout Boer leaders, Piet Retief and Gerrit Maritz. In its Voortrekker Museum visitors see relics of the Great Trek as the trail leads through hundreds of Boer ox carts and to a small Boer town.

Neutrophilic Inflammation

present-day Zululand, a 10 000 square-mile reserve of round beehive huts and cattle kraals. The once warlike Zulus have hung up their spears to follow peaceful pursuits. There are few men around the kraals, as they are employed in the neighboring cities. Zulu women as a rule stay home and grow vegetables.

Near the Zulu capital, Ishu we, we stopped at the primitive hut of a well-known native sculptor, Ntuli. This young man has refused tempting offers to come to the city and practice his art. He prefers to follow the tribal life of his ancestors. His models are Zulus and wild animals of wild and lush. His hut has no windows and no chimney. But with clay right outside his door and wives to cultivate his fields, he has everything he needs to make him happy. His statuettes sell for good prices, and he can sell all he makes.

"Physically, the Zulus are different from white people," he said. "Their legs and even their ears are shaped differently. I prefer to stay here and model my own people."

I saw primeval Africa, wild and unspoiled, at Hluhluwe Game Reserve, deep in Zululand.*

Hluhluwe (the name means "Land of the Thorny Climbing Plant" and is pronounced "shloo shluwee") is a 40,000-acre reserve set aside by Natal Province. Wild animals roam through it just as they did before white men came to Africa.

As we drove along the winding road into the barbed-wire enclosure of the reservation, we counted 11 kinds of animals we had never seen before. It was near dusk, which, like dawn, is a likely time to find the beasts coming out of the bush to drink and feed.

Gnu Looks Like a Horned Horse

By the side of the road an ugly little wart hog trotted, its spiky tail held high. We passed a wildebeest, or gnu—familiar to crossword puzzle fans—which looked like a frolicking horse with horns. Then some antelopes, including an impala, tossing graceful lyre-shaped horns, and a topi kudu, with narrow white stripes (page 182).

We caught a glimpse of a hyena or two skulking through the underbrush. A duiker, another kind of antelope, about 26 inches high, leaped across our road. A waterbuck gazed at us inquiringly and bounded away. His rear marked with white circles as he had sat down on a freshly painted toilet seat.

A little farther along we spotted a group of black rhinos quietly grazing. We were not fooled by their peaceful appearance; the black rhino, when disturbed, is unpredictable and extremely aggressive.

"If one of them should charge you when you're on foot," we had been warned, "it's a

good idea to zigzag as you run, like a ship when a submarine chases it. Rhinos have poor eyesight and can see only straight ahead."

Nevertheless, my husband decided to try for a picture. Stopping the car, he got out and edged closer to the great beasts while I looked on anxiously. Then, as he raised his camera, one of the larger rhinos turned toward him and moved ominously forward.

I shouted a warning from the car. He paused long enough for one more picture, then jumped into the car. The driver stepped on the accelerator and we sped away.

Hunt for a White Rhino

The animal we particularly wanted to see and photograph at Hluhluwe is one of the rarest in the world—the white rhinoceros. A few carefully protected groups are still left on these primitive acres.

"You can tell them easily from the black," said Capt. Harold Potter, F.R.Z.S., Zululand's lean and sharp-eyed Game Conservator. "The white ones are larger and heavier and somewhat lighter in color, though they're not really white; and they have a square jaw. The black has an overhanging lip. Also, the white rhino feeds on grass, while the black feeds on tree shoots."

The visitor's camp at Hluhluwe is a group of cottages and rondavels. A kitchen is provided, but guests have to bring their own food. A candle by the bedside is a reminder that the camp's electric lights go out at 10 p.m.

Hoping to see a white rhino, we were up and out at dawn. We had to depend on our chauffeur to find the animals, often only dimly visible in the bushy jungle.

Our car moved on to a road that was little more than a path, and finally into a tree-dotted valley.

"Look!" exclaimed the driver. "White rhinos under the thorn trees! Six of them!"

Again my husband had his camera ready, and he got an unusual picture, since white rhinos are seldom seen in groups larger than two or three (page 188). They are less aggressive than the black ones, despite the fact that they weigh about a ton more and have an almost armor-plate skin.

Some of the most interesting residents of Hluhluwe, to me, were the hornbills, large birds with great hornlike beaks and a very odd family life. There are several varieties, and most of them follow the same peculiar custom: at nesting time the female, with the help of the male, walls herself up with mud inside a hollow tree. Only a small hole is left, through which the male feeds her and the

* See "Roaming Africa's Unfenced Zoos," by W. Robert Moore, *National Geographic Magazine*, March, 1950.





- Six Water Rooms,
• Race Night, Game
Themed, Turn Fees

As a result, the *Journal of Management Education* is the only journal in the field to offer a complete, up-to-date, and accessible guide to the field of management education. The *Journal* is the only journal in the field to offer a complete, up-to-date, and accessible guide to the field of management education. The *Journal* is the only journal in the field to offer a complete, up-to-date, and accessible guide to the field of management education.

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As the dimension of \mathcal{Y} is finite, the set of all $\mathbf{y} \in \mathcal{Y}$ is compact. The function $\mathbf{y} \mapsto \mathbf{y}^T \mathbf{A} \mathbf{y}$ is continuous on \mathcal{Y} . So, there is a $\mathbf{y}^* \in \mathcal{Y}$ such that $\mathbf{y}^{*T} \mathbf{A} \mathbf{y}^* = \lambda_1$ and $\mathbf{y}^{*T} \mathbf{A} \mathbf{y}^* = \lambda_n$ for all $\mathbf{y} \in \mathcal{Y}$.

The first thing I noticed when I stepped out of the plane was the humidity. It was a warm blanket, wrapping around me in a way that felt both comforting and overwhelming. The air was thick with the scent of tropical flowers and the distant call of birds. I had heard that the weather was perfect, but I didn't realize how much it would affect me.

— 25 —

1. $\frac{d}{dt} \left(\frac{1}{2} m v^2 \right) = \frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right) = m \dot{x} \ddot{x}$



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Indian Ladies Stroll Down a Portuguese Sidewalk in East Africa

When the Portuguese came to East Africa, they brought with them a laboring class of indentured laborers to work the land. These laborers were known as "Luzimbo" or "Luzimbo" and were used for various purposes. Now, as farmers, traders, shopkeepers, and other professions, they form an important part of the African population. Africa alone has 150,000 Indians and 150,000 Portuguese. These women walk in Lourenço Marques, Mozambique.

... sometimes for several months. Finally, when the young are ready to fly, the mother ducks down the will.

Secretary Bird Wears a Quill Pen

Another odd specimen of Hottentot is the secretary bird, known only in Africa. It has a long, stiff black head feathers that look much like quills worn behind the ear of a secretary clerk. To complete the Hottentot look it has black feathers covering its upper body, like velvet knee breeches, and pinkish-brown lower body.

The secretary bird is not so molly clerk-like as it looks, however. Stalking veld and scrub for its prey, it may swoop down on a snake, lift it high in the air, and drop it to the ground to be devoured for the kill.

From Hottentot we took a side trip northward to Lourenço Marques, a good and seaport of the Portuguese Province of Mozambique.

blip e. Its Provincial Museum has a fine natural-history collection, realistically mounted and out in the open so children can touch the animals if they want to. Here we were shown a variety of birds, including many birds we had recently seen.

Particularly interesting was a small bird called the common honey guide, which cooperates with other animals in getting by the contents of the wild bee's nest. This bird cries and chirps to guide people or honey-eating animals to the sources of honey. Then, when the hive is opened, it gathers its share of the loot, both honey and wax.

The honey guide may possibly prove to be important to medical science, we learned later. Dr. Herbert Friedmann, Curator of Birds at the U. S. National Museum in Washington, D. C., is making a study of the honey guide's peculiar ability to digest wax.

This may provide a method of attacking the waxy envelope that protects tuberculosis germs from medication.

Mozambique has been Portuguese territory only for four and a half centuries, though the first settlements were only scattered fortresses along the coast. Vasco da Gama, in March, 1498, sailed into the Arab-held port of Mozambique during his original historic trip to India around the Cape.

Don't Put the Lions

"Don't bathe; there are often crocodiles in the smallest pools. Don't become alarmed if lions stand and stare at your car . . . The lion's nose tells him at once that a car is not food to eat . . . Don't imagine because the lions are peaceful that you can go up and pat them."

Such are routine instructions for visitors to Kruger National Park, world-famous game

preserve. Without our steel-bodied car we would not have been admitted. Visitors, for safety, are forbidden from wandering about on foot, bicycle, or horseback, or after dark.

Kruger Park, on the eastern border of Transvaal Province, was started in 1908 through the efforts of the Boer statesman, Paul Kruger, who was then president of the independent South African Republic.

Here, in an area nearly as large as Massachusetts, wander elephants, giraffes, hippopotamuses, zebras, and antelopes of all kinds. Kruger's lions are famous but sometimes coy. Even for the British royal party in 1947 none made an appearance.

With our host, superintendent H. C. van der Veen, we set out one morning just as light was breaking. We passed a jungle scavenger, a cockatoo, and then a herd of antelopes moving as peacefully as cows (page 183).

Honking at the King of Beasts

Suddenly a tawny shadow loomed ahead of us, and we almost drove over two blase lions stretched out in the road. They had evidently just finished breakfast—perhaps on one of the herd we had just seen—and were too lazy to get up. They flicked their chops and paws, looked at us superciliously, and rolled over in the dust. Finally, after we had photographed them, we shouted and honked our horn at them. They got up leisurely and moved to the side of the road and lay down again to finish their nap (page 161).

We turned a corner, and there by the side of the road stood a giant giraffe, head scarred and seemingly indifferent to traffic (page 185). But that was only a pose. He lumbered behind a tree and peered out at us from the very top, first from one side, then the other.

"Sorry," said Mr. van der Veen as we drove on, "that you didn't see our sable antelope."

Almost as he spoke, several of these magnificent beasts loomed in the high grass, a study in black and white and arched horns.

Back at his attractive stone home we found that even in this wilderness modern inventions have their place.

"Malaria used to be a curse here at this time of year," he said. "Every year we sent our children away for six months. Now, with the daily spraying of DDT, we feel safe enough from the mosquitoes to keep even our two-year-old baby with us."

Across the Transvaal we drove through mile after mile of green and fragrant orange groves. These trees, well over half a million of them,

belong to Zebediela, one of the largest citrus estates in the world.

Zebediela owns and operates its own local railroad, factory, laboratories, and hospital. It hires more than 3,000 natives and 300 Europeans.

The venture grew out of the daring and imagination of the late I. W. Schlesinger, who came to Johannesburg from America as a penniless immigrant and started a chain of successful enterprises.

On an exploring trip into the Transvaal 30 years ago, he saw the possibilities of its rich and virgin soil—if it could be supplied with water.

Backed by vast sums of enterprise capital, the Schlesinger Organisation cleared the land, dammed near-by rivers, built irrigation channels, and bored deep wells.

A golden harvest was pouring forth when an epidemic of relapsing fever, carried by a soft-shelled tick (*Ornithodoros moubata*), broke out among the workmen. The disease threatened the very existence of the project. It was checked only by burning out the whole village, where thatched roofs and clay floors harbored the tick. Now the workers live in new tick-free houses made of concrete.

Zebediela's oranges are shipped to other parts of Africa and north to England and the Continent.

South Africa Has Three Capitals

On our way back to Johannesburg we stopped in Pretoria, capital of the Transvaal and administrative seat for all South Africa. Its tree-lined avenues and classic architecture reminded me of Washington, D. C.

The Union of South Africa, like the United States, has its government divided into three segments—administrative, legislative, and judicial. But, unlike our government, in South Africa each segment has its own capital city.

Pretoria is the home of South Africa's chief executive, the Governor General, of its Cabinet ministers and civil service; it is also the residence of foreign diplomats. Cape Town is the seat of the Legislature. And Bloemfontein, provincial capital of the Orange Free State, is the headquarters of the national judiciary.

Paul Kruger, the Boer fighter who founded Kruger Park, lived and is buried in Pretoria. The city has preserved his old homestead, a long, one-story building, just as it was in his time. There visitors can gaze at his personal belongings and recall the man, with his pipe, cane, and familiar top hat; his Bible, and his



knife with which he once amputated his own finger after a gas explosion had injured it.

Pretoria's huge granite Voortrekker Monument, unveiled in 1949, is one of the most impressive I have seen. The central structure holds statues and friezes showing the history of the Great Trek. Surrounding it is a defense circle of sculptured trek wagons. From behind their wagons the treklers often fought it out with hostile natives, just as American pioneers battled with our western Indians.

Pretoria has roots in the past. But it is also the Union's largest steel producer and was the site of its first large-scale steel production.

"Johburg" Miners Dance Off Steam

During our second stop in Johannesburg we saw our biggest show. It comes on Sunday, when the native workers of the gold mines forget they're "civilized" and dance to the primitive rhythms of their old tribal life.

We watched the dancing from seats in a big stadium, similar to our own football bowls. There was room for an audience of three or four thousand people, with sections divided equally between native and white spectators, all admitted free. The arena was turned over to the dancers.

They wore a fantastic assortment of barbaric finery—leopard skins, beads, ostrich feathers and leg rattles. Most of this adornment was simply superimposed on their European work clothing.

"It's the favorite amusement," said our host at the Rose Deep Mine on the edge of town. "But just to make sure that the fun doesn't get too violent, you'll notice the spears are wooden."

Each tribal group had its own special act, posturing, kicking, advancing by jumps, stamping, whirling, or throwing themselves on the ground. Some of the dancers carried rhinoceros-skin shields with their wooden spears, or poles ending in ostrich tails which looked like kitchen mops.

Others wore big, loose rubber boots. They kept rhythm with these by knocking them together or slapping them with their hands.

Musical instruments were quite ingenious. There were drumheads stretched across bat-

rels, tin whistles, and marimbas made of planks, copper tubing, and tin cans. One dancer rattled out his own accompaniment with stones in a shoeblackening can. A group of men in women's clothes chanted accompaniment, representing village women.

Mine workers are recruited from lush villages and signed to contracts ranging from nine months to two years. A beginner's pay is three shillings (about 45 cents) a day, but it goes up rapidly as he gains skill. Besides the wages, the company provides living quarters, hearty, nutritious meals, and free beer.

We saw the huge vats of beer from which the miners get their daily ration, and visited the dormitories where they sleep in bunks grouped around a central fireplace. Each tribal group lives by itself, as they sometimes fight, group against group, and when they do, it is always to the death. These workplaces are used for cooking as well as heating, since each man receives three pounds of uncooked meat a week in addition to his regular meals.

A portion of the miner's money, we learned, may be withheld as a nest egg. With this the miner can go home as a man of consequence. Later he may want more money and return to the mines for another contract term. If he does, he keeps his old seniority and pay.

But often the retired gold miner uses his savings to set himself up for life, with land and cattle. He trades his cattle for a wife or wives, and settles down. In the South African bushlands the price for a wife is five cows!

Smoke That Thunders

Flying over Victoria Falls, we were balked of our first look at the cataract by the mists that veil it.

"At certain seasons," our pilot said "those mists are like a smoke column. We can spot it 80 miles away and set our course by it."

We didn't get a clear view of the "Smoke That Thunders," as the natives called the falls when Livingstone discovered them in 1855, until we flew over them again in a chartered plane. The bright sunlight pierced the mist, and we could see below as the placid Zambezi River takes its dramatic 354-foot dive.

"Mission accomplished," we flew to Southern Rhodesia's Bulawayo, a young city in the still young country fathered by Cecil Rhodes.* Near by, at the crest of the granite-forded Matopo Hills, stands Rhodes's grave, surrounded by massive boulders.

But Rhodes, who died early in 1902, belongs to Africa's present. We had a date with the past, at the site of one of the world's great empires.

* See "Rhodesia: Hopes and Fears of Cecil Rhodes," by W. Robert Moore, *NATIONAL GEOGRAPHIC MAGAZINE*, September, 1944.

← Foaming Waters of the Urogeni River Plunge 365 Feet Down Howick Falls

This large cataract, more than twice the height of Niagara Falls, lies only 15 miles northwest of the seat of Portenburgh, Natal's provincial capital. Howick Falls, like Niagara, has been retreating for many centuries, leaving now a downstream a narrow watered gorge along the Urogeni. Thousands of visitors view the falls each year. Near by areylvan picnic spots and handsome resort hotels.





Giraffes, Gawkily Legs Spread Wide, Drink at a Water Hole in Southern Rhodesia

With their long necks spread wide and legs far apart, giraffes have been seen drinking at a water hole in the southern Rhodesia. The animals are seen drinking at a water hole in the southern Rhodesia. The animals are seen drinking at a water hole in the southern Rhodesia.

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Continued on page 106

Continued on page 106



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THE GREAT TEMPLE OF THE ANCIENTS

Ancient's Great Elliptical Temple Is a Mystery from Africa's Dark Past

The ancient temple, known as the Great Elliptical Temple, is a mystery from Africa's dark past. The temple is a large, elliptical structure built from rough-hewn stones. It is surrounded by a dense thicket of trees and foliage. The temple is a mystery from Africa's dark past.

"You can't make it," they told us. "The roads are washed out. There's no through train, no air service."

We managed, though. Our pilot back at Victoria Falls had simply arranged with a colleague for us to hire a plane, one of those bush planes that fly all over the continent throughout much of Africa.

Thus 150 miles east of Bulawayo (travelling by car over partially paved road) we came to Zimbalawe, the ruins of a city built by an unknown people at an unknown time. Even the name is a puzzle. It may combine two Bantu words meaning "stones" and "houses."

The massive structures which make up the "Great Zimbabwe" are built of hand-hewn stone skillfully fitted together without mortar. They were laid out carefully in a geometric plan. At one end is a vast and timeless Optical Temple. Its thick inner and outer walls enclose platforms and two towers.

Who Lived in Zimbabwe?

Near by are the scattered stones of a Valley of Ruins where people may once have lived. Beyond rises the Acropolis, a hill crowded by oblique fortifications. Here the granite walls were so constructed as to merge with and make the greatest defensive use of the giant boulders already on the spot.

Wandering about, I was reminded of Machu Picchu, in Peru, where another vanished race has left similar ruins of mortartless stone.*

But Muchu Picha is linked with the Inca and pre-Inca peoples. Zimbabwe lacks authentic records or inscriptions and has few relics to hint at a long-lost past. Not even burial grounds identify its people.

There are clues to what their occupation was, old crucibles for melting gold have been found in the ruins. Medieval Arab and Portuguese explorers once told of some such fabulous gold-mining center in the interior.

Archaeologists have argued about Zimbabwe ever since Adam Renders, American hunter and trader, found the ruins in 1868.

Early investigators thought the settlement had been in existence thousands of years. Some suggested that ancient travelers, perhaps the Phoenicians or Sabaeans, had built the city. Others theorized that it was in the Biblical land of Ophir; that it was the source of gold for Solomon's Temple and of the gifts brought by the Queen of Sheba.

Modern archaeologists make no such claims of antiquity, but the detective work goes on. Since we were at Zimbabwe, U. S. physicist have examined a piece of wood from one of the ancient walls. The archaeologists used a yardstick, the Geiger counter, they have measured the radioactivity of the wood and estimated its age: about 1,350 years!

The gold that once helped support Zimbabwe is still important in Southern Rhodesia's economy. Last year nearly half a million ounces were taken from big and little mines scattered over the country. Many of them dig into the same veins worked by the early race of unknown miners.

"We know the ancients worked our mines," said Mrs. Bill West, who with her husband owns and operates a gold mine near Zimbabwe. "We've found their crude implements in the old mine shafts. One of the theories about the many abandoned diggings found around here is that the miners gave up each time they struck water. Since they didn't know how to pump it out, they had to move on."

We too were moving on. We were scheduled to make a reconnaissance of the depths of Africa, depths until recently penetrated only by men pushing on foot through swamps and jungles.

From Zimbalawe back to Bulawayo the air miles flown by. We flew on to Salisbury, Southern Rhodesia's capital, and from there over the tip of Portuguese Mozambique and the high plateaus and mountains of the British protectorate, Nyasaland.

We crossed Lake Nyasa and the game lands of southern Tanganyika, to stop at the Indian Ocean port, Dar es Salaam. Its Arabic name means "House of Peace," belying a stormy German-British history.

Finally, 400 miles farther, we landed at inland Nairobi, the lively capital of Britain's Kenya Colony and Protectorate. Europeans in Kenya number only about 50,000, less than one percent of the Negro population. During our stay there, however, we could see little trace of the racial unrest which was to erupt less than a year later into a series of bloody massacres by the Mau Mau, a Communist-inspired organization of Kikuyu tribesmen.

Hints for Travelers

From Kenya we visited Uganda, Belgian Congo, Ethiopia, the Sudan, and Egypt.

We found travel in Africa pleasant and easy for the most part, the scenery fabulously beautiful, the hotels and inns good as a rule. The food was uniformly excellent. But for travelers who expect to follow our route, I can offer this advice:

Take clothes for all climates. Even in equatorial Africa it's cool on the plateaus, 6,000 or more feet up, and a coat is useful. At Zanzibar and Dur es Sakaan, on the other hand, the thinnest, lightest things in the wardrobe are the most comfortable.

Be careful addressing your mail. When

* See "Peru: Homeland of the Warlike Inca" by Sir Ross, NATIONAL GEOGRAPHIC MAGAZINE, October, 1957.



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Rundavels Copied From Natives' Circular Huts Are Africa's Own Tourist Camps

Simple to design and construction, these thatched round huts are fit a hundred into the landscape. They are popular to travelers in many parts of Africa. Some are luxuriously furnished with electricity and modern conveniences. Here the author inspects a rondavel in Zululand's Hluhluwe Game Reserve.

sending letters home to the United States don't, for a city such as Richmond, put "U. S. A." after it, or it will probably be delivered to Richmond, Naval, in the Union of South Africa. There are many towns whose names duplicate ours, and "U. S. A." are the initials in common use for the Union of South Africa as well as for the United States of America.

Be sure to make hotel reservations in advance. Hotels and inns, with few exceptions, are small and are often full.

Keep your passport, visas, and travel records with you at all times. Traveling in much of Africa, you are moving only from one part of the British Commonwealth to another. Just the same you will be asked to show your papers at each airport.

This is because each political subdivision has its own government: Nigeria is a colony and protectorate; the Union of South Africa is a dominion consisting of four Provinces; Northern Rhodesia and Uganda are protectorates, and Southern Rhodesia a self-governing colony; and so on. In some cases, of course, as in the Belgian Congo, Ethiopia, and Egypt, you are moving under a different flag entirely.

For the same reason, it is wise not to take too much of one kind of money with you, as the money and postage stamps, of course, change at each border. Also, each time you

cross a frontier you have to give account of the money in your possession.

Members of the National Geographic Society may be interested to know there are 8,000 fellow members in South Africa alone. They welcomed us in every city we visited.

Barefoot Waiters and Jungle Drums

Everywhere we went in Africa we found the strange contrasts and contradictions of a continent in transition. Here air-conditioned hotels, model farms, and dial telephones exist side by side with jungle drums, wild elephants, and mischievous baboons. In excellent new hotel restaurants you are startled to find your meals served by a barefoot, white-robed waiter wearing a cummerbund around his waist and a fez on his head—the prevailing waiter's garb from Cape Town to Cairo.

Invariably we were impressed by the work British colonial governments are doing in the vast sections of Africa which lie under the British flag. Most of this work in modern times is devoted to improving the status, not of the English settlers but of the Africans; to eradicating disease, improving agriculture, and introducing new industries.

Schools, universities, and hospitals have been built; more are going up. And there is great consciousness that the long-range objective is to teach Africans to govern themselves.

BY SAMUEL W. McINTOSH

National Geographic Magazine Staff

TWELVE miles from downtown Washington, D. C., is a farm that breaks all the rules. Cows take heat baths. Weeds are planted in greenhouses. Fruit trees are sprayed with ground glass and disperse germs, and cockroaches are raised in jampered colonies.

The farm employs 2,000 hired hands—hundreds with scientific degrees—yet grows nothing for market. But from such day-by-day activities the American taxpayer reaps bounteous returns. The harvest of the United States Agricultural Research Center at Beltsville, Maryland, is knowledge.

Farm Magic in the Making

Crossbred cows swell in artificial tropics so that a few years hence dairy herds in hot southern States will give more milk. From greenhouse weed beds come better chemical weed killers for farms and lawns of tomorrow.

Orchards will be more resistant to blights because Beltsville injects trees with disease through tiny gashes cut by flying glass. With supercockroaches, immune to present poisons, scientists test new chemical killers.

Because of Beltsville and experiment stations like it in all 48 States, a revolution is taking place on the American land. The farmer's world has changed more in a single lifetime than in all the previous centuries man has cultivated the earth.

Today's farmer operates machines, unknown to his grandfather, that till his fields, fill his silos, mend his fences, and milk his cows. He plants seeds from which grow foods and fibers unheard of in this country a few decades ago. He raises streamer egg pigs that arrive in larger litters and give more ham and bacon, and sheep with longer, finer wool.

Spray Bombs and Midget Turkeys

Agricultural science affects the daily life of us all. What we eat tastes better, is more plentiful and more nutritious. Much of what we wear lasts longer and costs less. Life is healthier and safer. Look at a few examples:

The first tests of DDT in this country were made at Beltsville following its discovery in Switzerland. The aerosol spray bomb, credited with saving thousands of lives in World War II by preventing insect-borne diseases, sprang from the ingenuity of two Beltsville scientists (page 218). The spectacular weed-killing powers of a chemical named 2,4-D were discovered on a dandelion-choked lawn at the Research Center.

Few such achievements bear Beltsville's name. Until "Beltsville turkeys," plump with white meat, began appearing in stores a few years ago, most city housewives had never heard of the place.

But through the pages of scientific journals, wherever men are seeking new horizons in farming, the sprawling experiment station on the outskirts of the Nation's Capital is fast becoming world-famous.

"Many farmers in my country can tell you where Beltsville is," a foreign visitor told me one day. "The name is as well known to them as any town in the United States."

This was a man who had traveled 6,000 miles to see the Research Center. An official of the Turkish Ministry of Agriculture, he had come for a six months nationwide training course under the Point 4 technical assistance program.

On tours arranged by the Departments of State and Agriculture nearly 10,000 visitors went to Beltsville in 1952. Farmers arrived from Denmark's green Garryland and from the golden wheat country of the Dakotas. Agricultural students signed in from universities in Greece and Lufkhanli colleges of the Great Plains. County agents came from rural offices in India and Indochina.

Green Grows "The Combination"

Those who cannot go to Beltsville telephone or write. In one office I noticed a cardboard carton piled high with papers and pushed under a table.

"Our filing space gave out," a scientist said. "There are 10,000 letters in that box, all received in the past three months and all requesting advice about lawn grass."

This same man walked me across a springy carpet of fantastic new turf developed at Beltsville. "The Combination," he called it.

"This grass won't lose color in midsummer heat," he said. "It thrives in poor soil without watering, crowds out weeds and crab grass, and resists diseases and insects. It is so tough that on a golf course it is virtually devil-proof."

Secret of The Combination is a remarkable strain of grass that came originally from Korea. Its name, Meyer zoysia, commemorates a Department of Agriculture plant explorer, Louis N. Meyer, who collected zoysia in China after sending home many strains of the zoysia family.*

* See "A Hunter of Plants," by David Fairchild, NATIONAL GEOGRAPHIC MAGAZINE, July, 1909.

Planted with a new bluegrass discovered growing on the Merion Golf Club course near Ardmore, Pennsylvania, a few years ago, Meyer zoysia forms an almost perfect turf by the rigorous standards of the United States Golf Association (page 210).

Meyer zoysia is not yet available in seed form, but a few enterprising nurserymen sell plugs and blocks of Meyer sod, which may be set into an existing lawn. Under good conditions they spread and join in two summers. The new grass has been planted thus in the lawn of the White House.

I paid \$5 for a square foot of Meyer sod from a near-by nursery and sawed the green-haired cake into 48 small blocks with a bread knife.

Following directions, I spaced the blocks a foot apart in a corner of my yard. Occasionally I watered and fertilized them.

By Labor Day lush green tufts marched along the fence in geometric procession. From each tuft new runners spread like spikes.

When the zoysias re-plugged into the rest of the lawn, Merion bluegrass must be seeded also. Merion grows best in the cool months of spring and fall, whereas the Meyer thrives in summer's hottest weather. Together they provide even cover almost all year.

Uncle Sam—Farmer

Beltsville is the Nation's largest agricultural experiment center.

Its fields and forests, barnyards and laboratories stretch across 11,000 acres of rolling Maryland countryside.

Within the station, nine miles from one end to the other, are 450 buildings. In following the Center's 51 miles of roads I found an airport, a granary, a calvary, and gleaming acres of greenhouses.

At the Plant Industry Station, on U. S. Route 1, I talked with a botanist about the miracles being achieved there in the breeding of new hybrid crops (page 202).

"In any research," he said, "a scientist must ask three questions. How can it be made better? How can it be made cheaper? Can something new be made?"

Today American farmers grow an additional three-quarters of a bill on bushels of corn each year by planting hybrid seed. They raise golden tobacco far sweeter, milder, and lower in nicotine content than the leaf of Sir Walter Raleigh's day. Scientists at Beltsville are now producing Easter lilies as big as the bell of a trombone, and snapdragons and carnations half again as large as the usual variety. There are potatoes selected especially for potato chips.

Using well-known laws of genetics, plant breeders now transfer superior traits from one plant to another, much as farmers produce

a male by breeding jackass and mare. The result is increased vigor, greater yield, and healthier, better adapted crops.

Hybrid corn has many things in common with the male. The offspring of two different strains outproduces either parent. Yields jump spectacularly, just as a male's work capacity is greater than that of either parent.

Four Bushels of Corn Replace Three

The first 40 bushels of hybrid seed corn were put on the market in 1922, and a spark was struck in the Corn Belt. By 1943 more than half of all U. S. corn grew from hybrid seed. Today the figure is above 80 percent for the Nation and virtually 100 percent in the Corn Belt.

As Dr. Albert H. Moseman, chief of the Plant Industry Bureau, put it: "The extra bushel in every four which hybrid corn gave us is worth enough each year to pay for all the research ever done by the Department of Agriculture."

To learn how closely agricultural research affects the average American, I set out to see how Beltsville is improving the Great American Meal—steak and potatoes, tomatoes, apple pie and cheese.

In a paddock at the animal husbandry barns I found cattle that had never eaten green grass nor had their forebears for five generations. Kept on concrete and bare earth, they live on precise test rations. Low-quality hay, grain and cottonseed, linseed, or soy bean meal control their vitamin A and protein intake.

"The idea," I was told, "is to find out whether prevailing notions of raising and feeding range cattle are valid. We have found several new ways to improve their nutrition."

Thus Beltsville helps ensure the quality and availability of tomorrow's beefsteak.*

Science Transforms the Spud

A potato specialist showed me how science works at beltside to give the common spud princely qualities. In a single year 50,000 hybrid potato seedlings may be grown in greenhouses. From these, breeders may get one new potato variety promising enough to christen with a name and release to field stations for further tests.

To breed a disease-resistant potato, scientists do not begin by planting sections or whole seed potatoes as do farmers. They work from the "fruit" of a potato plant, which many farmers, particularly where growing days are normally hot, never see.

Neither, I learned, had one red-faced radio commentator. One day at breakfast time he

* See "America's 'Meat on the Hoof,'" by William H. Nicholas, *NATIONAL GEOGRAPHIC MAGAZINE*, January, 1952.



Sunlight and Science Make the Plant Industry Sustain Uncle Sam's "Green Thumb"

Plants in the United States are not just growing, but they are growing with everything that grows. They eat soils, fertilizers, weed killers, and hybrid plants. This station is part of the United States Department of Agriculture, which is the largest and most important of the U. S. Government's research agencies.

It is a station that would grow unharmed in soil sprayed with fosathion dust.

It is a station where the tomato was discovered growing near Trujillo, Peru. Its fruit was only a quarter of an inch in diameter, but it was also infected with wilt disease. It was called "green tomato" among the people who grew it.

A research program began in 1936 which has produced hundreds of selections and tens of thousands of plants. In 1947 a new tomato variety was released from Beltsville. It was called "Beltsville Wonder" and was released from Beltsville. It was a new variety which was released from Beltsville. It was a new variety which was released from Beltsville.

It is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil.

Growth chemicals contribute to the apple pie as well as to the salad. Sprays containing active ingredients in 100 gallons of water from a pump are on the tree until they are ready for picking. The sprays are less fruit than the trees.

The station is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil.

Nutrition and Hormone studies, which result in golden brown skin, were put in a cleaning electric oven.

Scientific tastings were sampling the food for appetite appeal. The recipe, if approved, would be offered to thousands of restaurants, and factory cafeterias.

Most American-made food is made from products rather than raw materials. A process worker at the Department of Agriculture says: "The process of food production involves the use of many different kinds of food. It is a process of food production. It is a process of food production. It is a process of food production."

Hormones Speed Growth or Slow It

Each improvement in the things we eat results from long years of basic research into mysteries of soil and sun and growing plants. For all life depends finally upon that which springs from the earth.

Among the most startling of Beltsville's plant experiments are those with the so-called plant hormones, the growth regulators.

It is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil. It is a station where the tomato is grown in more than one hundred different kinds of soil.



Bellevue Park's Prize Bulls Walk Miles for Exercise Without Leaving the Barnyard

A 2,900-pound Holstein (farthest from camera) is yoked to pull the merry-go-round exerciser. Other bulls follow in line on spokes. Hammer Red Sindals (foreground) from left in cross blood lines with H. Stearns and L. Stearns (right) are also in the exercise line.

through a plant with Geiger counters. Technicians, however, are sometimes so powerful their effects can be traced to the second or even the third generation.

In Bellevue Park's barnyard in Illinois, I saw many such experiments that climaxed in strange ways. In one, other plants grew from seeds and high root systems.

Some growth regulators cause plants to ripen early. In spring they can make the "blowing stick" longer on the tree. I saw the same effect on flowering cherry trees in Washington, D. C. Other sprays reverse the process. They keep blossoms in orchards to prevent frost damage by forcing more fruit than can be harvested to good size.

Plant-growth scientists work as well with the wonder drugs of modern medicine, the antibiotics. They find that these potent compounds, which inhibit or destroy disease-producing bacteria, viruses, or fungi, will move through a plant somewhat as through the human body.

New antibiotics have been discovered in many plants. Beltsville chemists have isolated a crystalline substance from the tomato plant that stops its growth of certain fungi harmful to plants and animals. They have found active antibiotic elements in the sweet potato and California cabbage and cactus cactus.

and celery, broccoli, lettuce, and muskmelon.

From tomatoes, a chemical once found in tomato leaves and roots, medical researchers have produced the sex hormones, progesterone and testosterone. Even the complex hormone drug cortisone may someday be made from the tomato. So this is a delicious little more than a tomato.

Scientist Takes Pills of 2,4-D

In 1946, a scientist took 2,4-D, which kills weeds and the like, and found it was safe to eat. He found it was safe to eat.

Somehow the chemical stimulates plant growth when applied in microscopic amounts. But larger doses so oversaturate most broad-leaved plants that they burn up then begin to rot and have started to die. They are literally starved to death.

When scientists at Beltsville first discovered 2,4-D's weed-killing powers, they tested it thoroughly on near-a golf courses and experimental plots. They were still not sure, however, whether it could be used safely around farm animals or man.

For 100 days a cow was fed grain with enough of the plant poison to kill a tree. From samples were taken and analyzed for 2,4-D. The plants showed their own

2,4-D in the blood, but the cow was unharmed and the chemical did not appear in her milk.

Then Dr. Ezra J. Beams, a Department of Agriculture scientist, since retired, took capsules of pure 2,4-D every day for three weeks. He suffered no ill effects, proving that the new miracle spray could be used safely. In 1945 it was released to the public. Some 30,000,000 pounds a year are sold.

Even newer weed killers are now being tested. I saw selective plant poisons applied to soil from which corn, wheat, and soybean seedlings would grow unharmed, but never a weed. Using such "pre-emergence" soil treatments, farmers may one day mix weed killers with fertilizer and watch crops grow in weed-free fields.

Mystery of the Flowers

For 33 years scientists have known that the changing length of day and night is a basic factor in plant life. The phenomenon is called photoperiodism. But how it works is still a mystery.

Some plants blossom only in the lengthening days of spring. Others require more darkness than light and bloom in the fall when the nights are becoming longer.

Beltsville discovered that darkness, not light, times the miracle of flowering. When the night shortens or lengthens to a certain span, an unknown trigger mechanism tells plants that it is the season to blossom.

Sometimes if a plant's normal night is broken by even a short flash of light, it can be fooled into reacting as if there had been two short nights rather than one long one. Greenhouse operators already use this principle to withhold the blossoming of chrysanthemums and poinsettias until late in the fall, producing flowers timed to football crowds or the Christmas holidays.

In a dark basement laboratory I watched plant physiologists study photoperiodism. At the end of a long narrow room a rainbow suddenly appeared. In a swath of multicolored light stood a line of potted plants. A scientist in short sleeves moved into the light, shifting plants across the beam (page 212).

"Different wave lengths of light cause plants to behave in different ways," the experimenter said. "A few minutes under a certain light band sometimes can start a plant's blossoming process. Given another type of light, the same plant will not bloom at all."

"There seems to be a pigment, or set of pigments, in plants which reacts only to a particular wave length. But how this trigger mechanism induces flowering we don't know."

Evidence has been found that a photoperiod mechanism also operates in animals and birds. It tells them when to change the color of fur

or feathers, and when the mating season arrives. A difference of only 20 minutes in night length has induced snails in a Beltsville laboratory to begin laying eggs.

Crop Speed-up Fights 15-B Rust

Beltsville plant breeders vary light and darkness to force grain plants and vegetables into flowering in the middle of winter, producing an extra crop each year.

The time thus saved, by telescoping a couple of growing seasons into one and more quickly finding a resistant variety, could mean the difference between winning or losing a race against a plant disease.

Hard-pressed grain breeders at Beltsville and at cooperating State experiment stations are now racing one of the most dangerous new strains of an old disease ever to attack the wheatlands of North America. In 1950 a new stem rust, Race 15-B, suddenly became a grave menace.

Beltsville has 13,000 different wheat varieties, gathered from all parts of the world. By the end of 1952 every one had been screened for germ plasma resistant to the scourge. The tests include sending new strains of wheat to South America, where even more virulent rusts are raving.

Plant diseases may be caused by fungi, virus infections, bacteria, or nematodes.

Nematodes that prey on plants exist in the soil as microscopic wormlike organisms. Some types are beneficial to man, such as those that attack nematode pests and help break down animal and vegetable matter in the earth. But others are highly destructive—for example, the golden nematode, dreaded by potato growers.

Infesting fields, harmful varieties attack plant roots, sap their strength and vitality, and leave crops stricken (page 217).

Nematodes are among the hardiest and most numerous living things in the world. In laboratory tests some can survive temperatures approaching absolute zero, 459.69 degrees below normal zero on the Fahrenheit scale. They have been found in Antarctic moss. Others have been held dormant up to 39 years, then heated almost to the boiling point. Still they survived.

New Crops from the Wild

Yet in recent years basic research at Beltsville and other U. S. nematode laboratories has resulted in commercial development of new soil chemicals able to control these minute enemies of the farmer.

Plant diseases sometimes bring an entirely new farm crop into being. Chestnut trees of the United States once provided the leather

(Text continued on page 213)



Boston Likes Brown Eggs New York Prefers White; a Beltsville Gadget Sorts Them

WASHINGTON, April 12.—An automatic egg-sorting machine, which sorts eggs by color and size, was demonstrated here today. The machine, which was invented by a Beltsville, Md., farmer, is the first of its kind in the world. It sorts eggs by color and size, and is the first of its kind in the world.



UNIVERSITY OF CHICAGO



To get more information, see

[illegible][illegible][illegible]



Section of the new building, showing the new wing and the old wing.

The new building is a large, multi-story structure with a prominent red roof. It is situated in a grassy field, and the old wing is visible in the background. The new wing is a long, rectangular building with several windows. The old wing is a smaller, more irregular building with a red roof. The new wing is the main part of the building, and the old wing is a smaller addition. The new wing is the main part of the building, and the old wing is a smaller addition.

Apartment Dwellers Welcome Beltsville's South White House

As the new apartment building at 1001 South White House is completed, it will be the first of its kind in the city. The building is a four-story structure with a total of 100 units. It is located in the South White House area, which is a new development in the city.

The building is a four-story structure with a total of 100 units. It is located in the South White House area, which is a new development in the city. The building is a four-story structure with a total of 100 units. It is located in the South White House area, which is a new development in the city.




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family, professional, and animal hospitals. This has been the source for the following information:

[The page contains faint, illegible handwritten notes.]



The New York Public Library

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

2. Next, it is important to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing data sets.

3. Once the information is gathered, the next step is to develop a plan or strategy to address the problem. This may involve breaking the problem down into smaller, more manageable parts.

4. The fourth step is to implement the plan. This involves putting the strategy into action and monitoring progress as you go.

5. Finally, it is important to evaluate the results of the process. This involves comparing the actual outcomes with the expected results and identifying any areas for improvement.

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Journal of Agricultural Research, Vol. 1, No. 1, 1914, pp. 241-242.

* Atomic By-products Find Protective Uses in Agricultural Research

Atomic by-products, such as thorium, uranium, and light elements, are being used in many ways in agricultural research. The following are some of the most important uses of these products in the field of agriculture:

* Light, X-ray and Invisible, Controls the Life Cycle of Plants

Light, X-ray and invisible, controls the life cycle of plants. The following are some of the most important uses of these products in the field of agriculture:



industry with ample tannin, the basic chemical used in curing animal hides. But the native chestnuts are gone, wiped out by a nationwide blight. Even dead chestnut trees are disappearing into the tanner's vat.

A wild desert plant called canaigre, which grows across dry wastelands of the Southwest, may take the chestnut's place, scientists told me. In canaigre's thick knobby roots, which look like gnarled sweet potatoes, a rich source of tannin has been found.

To enable farmers in dry regions to grow canaigre, high-yielding plants are being selected from the wild and domesticated. In effect, Uncle Sam's plant breeders are doing what the first farmers started with corn and wheat perhaps 3,000 years ago—developing a new cultivated crop—but in a few years instead of thousands.

A wild relative of cotton found in the mountains of Arizona has opened the way for cotton breeders to develop a new three-way hybrid with fibers unlike any other cotton ever grown in this country. I saw these fibers tested at Beltsville; they are 30 to 75 percent stronger than standard upland varieties of the Cotton Belt, and 20 percent stronger than Egyptian long-staple cotton.

Plants Travel the World

Today there are few domesticated plants anywhere in the world that have not been tested in this country for their agricultural possibilities, a Beltsville official told me. Explorers still search the globe for wild strains whose germ plasma might improve crops here at home. But most traffic is the other way.

"Nowadays," the scientist said, "Uncle Sam sends 10 plants abroad, to be planted by farmers in other countries for every one we find overseas and bring home."

The amazing power of the drug cortisone against rheumatoid arthritis has sparked a world-wide search for a plant from which the medicine might be made. So far, cortisone has been made for commercial use from an acid found in the bile of cattle, a source far too limited for the demand. But plant material may soon be used.

At the Glenn Dale, Maryland, U.S. Plant Introduction Garden near Beltsville, exotic vines and other leafy immigrants from Africa, Mexico, and South America grow in long greenhouses painted white to shield plants from the fall summer sun.

"Chemists now get cortisone from materials found in many plants," my guide explained. "Our problem is to find one economically profitable for farmers to grow."

Soybeans were virtually unknown in this country until plant explorers brought new strains from the Orient. Now grown on

15 million acres in the United States, they yield vegetable and industrial oils, animal feeds, flour, plastics, and even the foam used in fighting chemical fires.

Korean lespedeza, introduced in 1919, ranks as a multimillion-dollar forage crop across the south-central farm region of the Nation. Lucerne clover from Italy, crested wheat grass from Siberia, durum wheats from southern Russia (imported years ago before the Iron Curtain shut off exchange of plants with Soviet lands), tung nuts, avocados—the list of valuable gifts which far-traveling American plant explorers have brought to this country is almost endless.*

Agriculture is built on grass. The great food crops of the world are grass—corn, wheat, rice, millet, barley, oats, sugar cane. Grass means also the vast variety of meadow and pasture crops which sustain grazing animals.

Dairy Research Pays Dividends

In a scrubbed, clean-smelling calf barn I was initiated into Beltsville's dairy research.

"Our most valuable possession is not what we put down in scientific reports," a cattle breeder told me, "but what we have in our barns."

For 33 years a prize herd of Holsteins and Jerseys has been built, using seven generations of bulls with proved ability to transmit high-milking potential. From the experiment have come new standards for choosing dairy sires. Today's nationwide artificial breeding programs are based largely upon the proved-sire principle.

Crossbreeding of dairy cattle began at Beltsville in 1939, in the wake of the spectacular success stories of hybrid corn, swine, and poultry. To many dairy farmers, proof of their pedigreed herds, crossbreeding a cow still seems like rank heresy. But Beltsville's crossbreeding has produced amazing results, measured in higher milk yields and hybrid vigor.

Hump-shouldered cattle are common on the range, but not in U. S. dairy barns. At Beltsville, however, I found a bull of a foreign milking breed that may well revolutionize southern dairying. Mounted near a huge Holstein, he seemed almost a midget. But his burnished red black coat and high, skin-folded hump marked him as a true aristocrat far from home—a zebu bull, prince of the sacred cattle of India†

* See in the NATIONAL GEOGRAPHIC MAGAZINE "How Fruit Came to America," by J. R. Macneil, September, 1957; and "Our Vegetable Travelers," by Victor R. Boswell, August, 1949.

† See "The Lure of the World—Cattle and Their Place in the Human Scheme—Wild Types and Modern Breeds in Many Lands," by Avim Howard Samuels, NATIONAL GEOGRAPHIC MAGAZINE, December, 1955.

birds are the same; any differences in growth must be due to environment or feeding.

I saw one twin that was big and handsome, while his brother was a scrawny runt. The first had been fed a full ration, while the other received only enough to stay alive.

After six months the second calf is full-fed. Scientists then measure how much time and feed it takes to bring the animal up to weight.

Streamlined pigs grow in Beltsville swine barns. Seven new strains have been developed there by selective breeding through the past 18 years.

Six of the new strains are based upon crosses with the Danish Landrace breed. Each is longer, leaner, and more meaty than the American hog of old, yielding less unwanted lard and more pork, ham, and bacon.

Breeders have even produced dark-skinned sows that won't sunburn. Their appetites stay keen and their weight up, even in the hottest summer sun.

In one barn hogs may eat as much as they want, 24 hours a day. Contrary to the cliché that condemns "eating like a pig," scientists find that the hog never overeats.

Taming Beltsville's Turkey

Beltsville is perhaps best known for its undersized turkey bred to answer housewives' demands for a bird that would fit today's apartment-size refrigerators, small ovens, and small families (page 209).

The compactness of the Beltsville Small White turkey is the secret of its success. Although it grows to little more than half the weight of large gobblers, its breast is broad and heavily fleshed, and the drumsticks are both short and plump. Its quick-maturing qualities and good breeding record make it popular with growers.

The inside of an egg is of top importance to poultrymen. Devotees of poached eggs want a thick white to cover the yolk uniformly. But if the housewife finds a blood spot—

she shies like a frightened horse.

Egg candling is still done by dexterous packers who twirl each egg in front of a powerful light. At Beltsville I saw a new electronic candle, still under development. High-intensity filtered light is shot through the egg. If a blood spot is present, an electric eye "sees" it, and the offending egg is discarded.

Another fireless machine developed here in 1952 automatically separates eggs by the slightest variation in the color of their shells—from pure white through various shades of brown (page 231).

The machine got confused only when engineers ran through a few light blue eggs of the Araucana chicken of Chile. The eggs were

whisked into the light-brown basket—not a serious mistake, since chickens which lay naturally colored Easter eggs are a breeder's rarity in this country.*

A Secret of Growth from Chicken Feed

In long, low poultry houses at Beltsville ultraviolet lights burn all night. Installed originally for their germ-killing power, the dim blue tubes were soon found to be boosting egg production. Scientists still aren't sure why. This ultraviolet "prodding" is distinct from the egg-laying stimulus of ordinary incandescent light, a technique long familiar to poultrymen.

Researchers know by recent experience that startling discoveries sometimes come from such small clues. A few years ago the hunt for a better chicken feed put scientists on the trail of a new vitamin with amazing power to promote growth.

During World War II, animal-protein feeds such as fish meal or slaughterhouse scraps became scarce. Soybean-oil meal, rich in protein, was substituted on poultry farms. It made a nourishing feed, but something was missing. If no animal protein was present, the hatchability of eggs dropped, and chickens grew too slowly.

Because the first stomach of a cow is known to manufacture vitamins, experimenters added a little dried cow manure to the feed. Suddenly birds thrived. Chemists found a growth factor in the manure, but it was none of the known vitamins.

At that point a pharmaceutical firm, Merck & Co., announced its discovery of vitamin B-12. The ruby-red crystals could greatly stimulate growth, it reported. Beltsville tried B-12 on chickens, and it was found to be the missing factor.

As little as 18 billionths of an ounce of B-12, injected into the fertile egg of a hen fed a diet deficient in the vitamin, produces astonishing results in newly hatched chicks. At the age of five weeks they are nearly twice the size of brother and sister chicks hatched from untreated eggs.

Battling Animal Ailments

More recently, researchers in many laboratories discovered that some of the minute-working antibiotics stimulate animal and poultry growth. Today aureomycin, terramycin, and penicillin are being added to feeds in minute quantities. Baby chicks and young pigs grow faster and fatter on such wonder-drug feeds.

An early task of the Department of Agricul-

* See "Easter Egg Chickens," by Frederick G. Voris, *NATIONAL GEOGRAPHIC MAGAZINE*, September, 1952.

culture was to fight livestock diseases, many of which could be transmitted to man. At Beltsville's Animal Disease Station, on a hill-top ringed by a high fence, the worst plagues known to American farms are studied.

Brucellosis, for one, causes the loss of some 325,000 calves and a billion pounds of milk each year. In human beings the illness is known as undulant fever.

Ring Test Spots Bang's Disease

At the disease station I watched a technician make the milk-ring test, most widely used procedure on whole milk for detecting brucellosis, also called Bang's disease. In about two hours a purple ring formed at the top of the test tube, showing the milk had come from cattle infected with the disease. With this simple test receiving depots can check dirty herds by taking samples from cans of their condensed milk. If the test is positive, blood-sampling the herd isolates the diseased cows.

In another laboratory vaccines were being prepared and tested. There is no known cure for Bang's disease but immunization of cattle with such vaccines as Beltsville's Strain 19 is helping to stamp it out.

Beltsville's Zoological Division battles the multitude of parasites that prey on animals—protozoa, nematodes, tapeworms, etc. From work done there 15 years ago came a revolutionary drug named phenothiazine. First tested as an insecticide, it is now so widely utilized to control internal parasites of farm animals that four million pounds of it are used annually in the United States.

Man appeared to have gained a victory over insect pests when DDT burst like an atomic bomb in the insect world. But the enemies did not give up. Today there are flies, mosquitoes, and cockroaches that laugh at doses of DDT and other new insecticides which once would have meant their death.

New Weapons for Farm Warfare

Men who study insect immunity at Beltsville say it is not merely a matter of the survival of the fittest, with each new generation resulting in flies of greater resistance. They are certain that some basic physiological change or mutation takes place in insects, making them immune to once-lethal doses.

Against such acquired hardness newer and more potent insecticides have joined man's battle to protect his food and fiber.

I watched a worker in a gas mask applying parathion to a field of strawberries at Beltsville. Behind a bright-red tractor white dust billowed like a smoke screen.

Crops of the new phosphorus sprays and dusts such as parathion may wear gas masks

and protective clothing under hazard of illness or death. These poisons, benefited by products of World War II research in Germany, are closely related to the so-called "nerve gases."

"We use live insects inside glass tanks to test breathing filters," said a scientist who designs and checks protective masks. "Often it's the only way to detect extremely small amounts of poison in the air."

Other new insecticides, safer for use in homes and gardens, are coming from Beltsville. One is a substance similar in chemical properties to the active ingredients of the pyrethrum flower, among man's oldest insect killers and still one of the most effective. Aldrin, the man-made product, is now on the market.

China Sends Its "Thunder God"

Even newer is a family of potent insect poisons isolated at Beltsville from roots of China's "Thunder God" vine, *Tipterogium wilfordii* Hook. They knock out test colonies of agricultural pests at a strength of only one pound to 2,000 gallons of spray solution. Thunder God is already being grown at the Glenn Dale Introduction Garden; it may be another U. S. crop of tomorrow.

In Beltsville's greenhouses I saw plants that can bite back at insects. So-called "systemic insecticides," the newest weapon of entomologists, are absorbed from the soil into the sap stream. Tiny sucking insects attacking such plants are poisoned by the very leaves on which they feed.

Flowers, ornamental shrubs, and cotton plants have been made barely insect-proof with these new compounds. So far, because these systemic poisons break down slowly, they cannot be used on food crops.

Agricultural science does not stop at the backyard gate; research reaches grocers' shelves through study of better transportation, storage, and marketing methods. It touches our daily meals, our clothes in the closet, the refrigerator and washing machine, even the soap used in the washing machine.

Nutrition scientists study long-term effects of various diets on health by feeding different foods to rats. They duplicate human digestion in test tubes and beakers to learn how the body uses proteins.

At Beltsville are the chief Government laboratories studying textiles and clothing, foods, cookery, and home canning. Housing specialists design better farmhouses.

Beltsville experts ride produce trains from ocean to ocean across the United States, checking how fruits and vegetables respond to various methods of protection and packing as they travel through the bitter cold of a Dakota



Aerosol Sprays, Beltsville's Invention Battle Insect Showways from Abroad

A PIONEER U. S. agricultural spray, the Aerosol, which is a trademarked name for a type of insecticide, is being used by the U. S. Department of Agriculture to battle the pest problem of the world. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Working in the U. S. Department of Agriculture, the U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

In U. S. agricultural spray, the Aerosol, which is a trademarked name for a type of insecticide, is being used by the U. S. Department of Agriculture to battle the pest problem of the world. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Air Sprays Root Timber Thieves

From the Beltsville airport National Geographic photographer Jack Fletcher and I took a helicopter to a point in a bright-yellow forest in the U. S. Department of Agriculture's research plane.

We flew across the forest to a point where a large number of trees were being cut down. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Suddenly a large number of trees were being cut down. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

near the experimental purposes. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Each plane swung back toward the airport. The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Some of the most important research in the U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

The U. S. Department of Agriculture is the only one in the world that has a large number of insecticides in its arsenal.

Mount McKinley Conquered by New Route 713

Landing by Plane on a Glacier, Climbers Pioneer Western Approach to North America's Loftiest Peak

By BRADFORD WASHBURN

With Illustrations from Photographs by the Author

BILL F. MOORE, 47, of Fairbanks, Dr. Terris Moore above the sputtering of the airplane's idling engine. "I had led. 'Okay, here we go!'" The little two-seated single-engine craft started bumping down the gravel runway of the airport at Charltona Lake, 100 miles northwest of Anchorage, Alaska.

In another moment we were off on an adventure which already had my heart pounding with mixed feelings of excitement and, I must admit, a certain amount of apprehension.

Ahead of us, though invisible in a blanket of fog, towered the 20,000-foot snow-capped cone of mighty Mount McKinley, loftiest peak in North America.

McKinley was named in 1890 for the Republican presidential nominee of that year by W. A. Dickey, who was prospecting in the vicinity. Long before, the Alaskan natives had called it, more appropriately, Denali, the Great One. It had been climbed only six times before our 1951 assault.

Mountain Climbing by Airplane

We were going to try what time after time had been declared impossible—to climb Mt. Kinley's rugged West Buttress (page 240). More exciting still, we were going to try to do at least a third of the climb by airplane.

To accomplish this, Terry Moore would have to land his tiny plane on the unexplored surface of Kambina Glacier. This huge ice river writhes down McKinley's slopes between rock cliffs thousands of feet high.

Our expedition had a threefold purpose: first, to test my theory that McKinley's West Buttress actually offered a shorter, safer way to the top than the usual route up the north-east side; second, to study the geology of this tremendous mass of rock; and third, to do essential survey work for a new large-scale map of the area immediately around Mount McKinley. Part of this map is published for the first time in this issue of the NATIONAL GEOGRAPHIC MAGAZINE (pages 236-237).

Our undertaking was sponsored by the University of Denver, the University of Alaska, and Boston's Museum of Science.

McKinley's distinction as our continent's highest mountain alone would justify adding a map of it. In addition, it is the main feature of Mount McKinley National Park, which is

attracting increasing numbers of visitors now that the famous Alaska Highway has made the country accessible by automobile.⁶

Important, too, is the fact that McKinley's height and position, only 250 miles south of the Arctic Circle, make it an ideal laboratory for many kinds of scientific research.

Arctic Equipment Tested Here

During World War II three military expeditions used its high slopes to test clothing equipment, and food for troops and plane crews operating in extremely cold climates.

McKinley's heights also provide a lookout for observing cosmic rays, which constantly bombard the earth from outer space.*

It furnishes a fine opportunity for weather observations, tests of the effect of a decrease in oxygen on the human body, and high-frequency radio research.

It was to make this great natural laboratory easier to reach that we were seeking a better route to the top of McKinley and preparing a detailed map of its slopes and glaciers.

Ferry Moore, who was going to try to land me on Kithlina Glacier, is not only an experienced bush pilot but was also a resident of the University of Alaska (he retired this summer). If we could land successfully, he was to leave me there with a small radio, camped on a smooth snow plateau. After this it should not prove too difficult to fly in to the glacier camp my first three companions, Mr. Henry Buchtel, James E. Gale, and Capt. William D. Hackett. With the radio I could tell them before they even took off what the weather was like at my end of the line.

Kahilna Glacier is one of the largest in the Alaska Range and one of the roughest. To help us find our way up it, we had with us a

The Author: Dr. Bradford Washburn is a noted mountain explorer and director of the Museum of Science in Boston, Massachusetts. He has reached the summit of Mount McKinley, the highest peak in the world, and has explored the interior of the Arctic region. He is the author of *North of the Arctic Circle*, published by New York, 1936.

* "Wildlife of Mount McKinley National Park," pages 149-170 in this volume.

See "Trading Cosmopolitanism in Canada's North," by Martin A. Pommeroy, *Journal of American Studies*, 37 (1993), 1-23; *Maclean's*, January 1993.



A Redoubt Alutian Shows the Way to Lady Camps in Mount McKinley

As we entered the Fairbanks region, we were met by a group of Alutians, who showed us the way to the Lady Camps. They were the only people who had been to the Lady Camps, and they were the only people who had been to the Lady Camps.

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Glaciering Snow Peak Revealed

The valley we had been told was a snow-covered mountain. We had been told that it was a snow-covered mountain, and we had been told that it was a snow-covered mountain. We had been told that it was a snow-covered mountain, and we had been told that it was a snow-covered mountain.

As we entered the rocky region, a great tall, light-colored mountain appeared before us. It was the snow-covered mountain, and it was the snow-covered mountain. It was the snow-covered mountain, and it was the snow-covered mountain.

The valley floor below was now much higher, and a snow-covered mountain appeared before us. We had been told that it was a snow-covered mountain, and we had been told that it was a snow-covered mountain.

As we entered the valley, we were met by a group of Alutians, who showed us the way to the Lady Camps. They were the only people who had been to the Lady Camps, and they were the only people who had been to the Lady Camps.

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A Daring Irish Pilot and University President Blow the Explorers In

On a recent Sunday, a group of about 35 people gathered in a little plane with Buck and his family. They flew to a small town in the mountains of Colorado, where they stayed in a small hotel. The weather was perfect, and the people were very friendly. Buck and his family had a very good time, and they all enjoyed the trip very much.

For the first time, he said, he, two miles
from the scene, would have been utterly im-
possible to distinguish it from its rivals.

But now, as the day drew to a close, the
 sun had set, and the moon had risen, and the
 stars were shining brightly. The night was
 calm and still, and the air was cool and
 fresh. The moonlight shone on the water,
 and the stars twinkled in the sky. The
 night was beautiful, and the air was
 sweet. The night was a time of peace
 and quiet, and the air was a balm to
 the soul. The night was a time of
 rest and repose, and the air was a
 comfort to the heart. The night was a
 time of joy and happiness, and the air
 was a song to the spirit. The night was
 a time of love and affection, and the air
 was a promise to the future. The night
 was a time of hope and faith, and the air
 was a light to the path. The night was
 a time of peace and quiet, and the air
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 was a song to the spirit. The night was
 a time of love and affection, and the air
 was a promise to the future. The night
 was a time of hope and faith, and the air
 was a light to the path.

Symptomatic and Asymptomatic

Wilder, among the first came. A ray of sunlight appeared above, and a shaft of sunlight fell upon the snow. The light of day was upon us. We were in luck. We followed the lead of the first man, and in a few minutes we were at the bottom of the glacier. We took our chance. The snow was so deep, and the lumps so heavy, that we could not see the bottom. We cut the throttle, lowered the flap, and before I could believe it we were skimming the glacier. Then we settled for a perfect landing.

No sooner were we down than the sun was gone again. It was 6 o'clock, exactly one hour from Chelting. There was no time to lose.

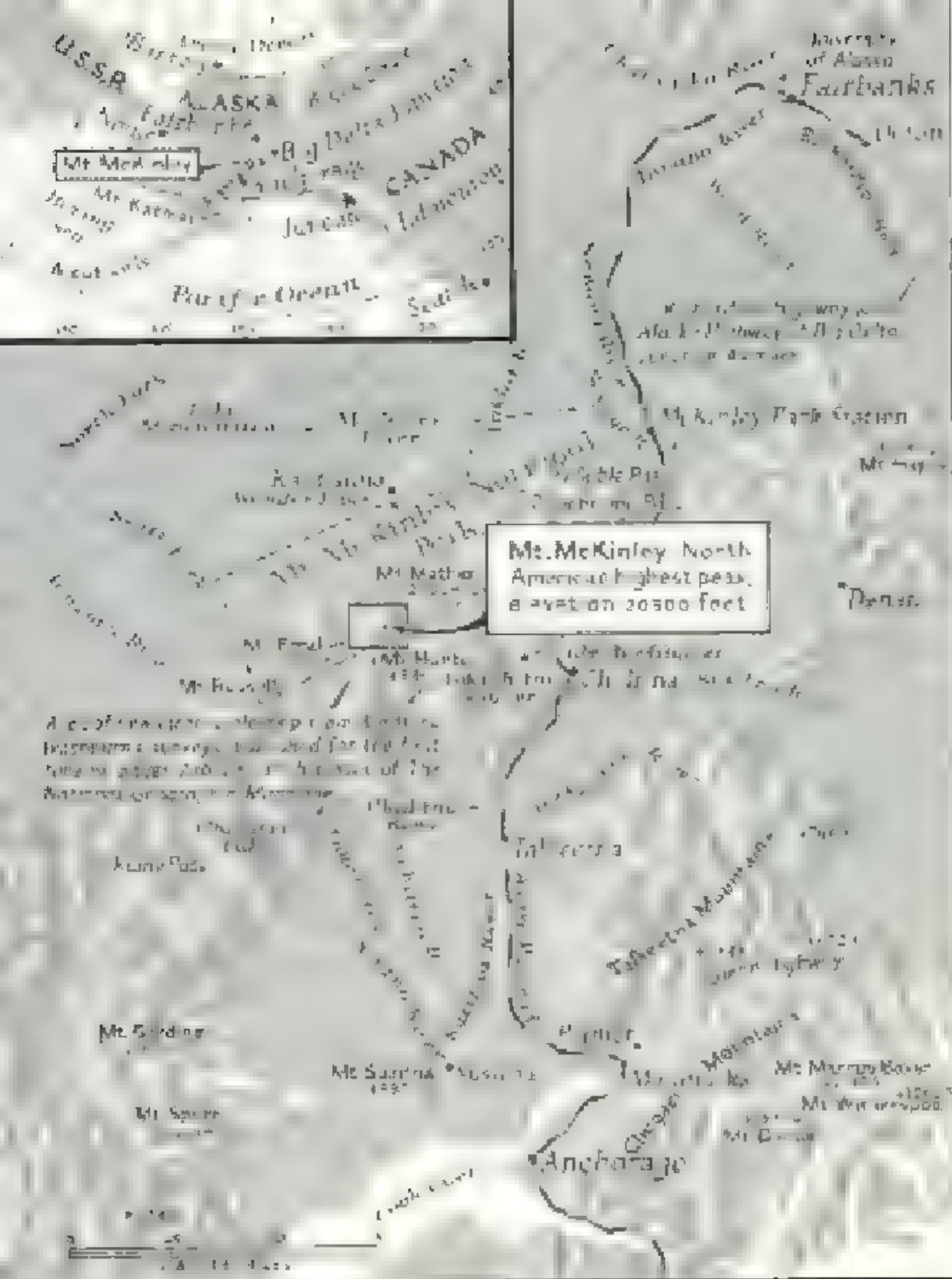
We plucked my supplies out on the 10th and lifted the plane tail around and away from the airfield by the 11th.

When a bird lands beside a soldier's partner, "The soldier's partner... A sound of wings... it was all... the drone of the motor... it died away... in the heat... the K... I could hear my heart beat."

I can remember that the rays of
light faded into the fog, and everything about me
not all sides, above and below, was white. An
hour before I had been 40 miles away at
Yellow Lake now there was a thin veil
across Mount McKinley.

At this point, it is believed Terry Moore's plane was equipped with aluminum skis that could be raised and lowered above the wheels for take-off on the gravel at Chikina Lake then lowered for landing on the snow.

A later day I was necessary in a glacial camp. With mine I had in hand a level spot dug out for my fire. Meanwhile, I set snow melting over a fine stove. For a month our only fuel was



Among National Parks Only Yellowstone Is Larger than McKinley

A broad reach of wilderness was set aside in 1917 to form Alaska's great wildlife refuge, now more than 3,000 square miles in extent. Statehood for Alaska would shift reports from California's Whitney (14,495 feet) to 20,300 feet McKinley as highest mountain in the United States.

be gasoline and our only source of water melted snow. Unfortunately, snow water is so flat in taste that drinking it is a real effort.

Need More Liquids on Heights

At high altitudes climbers must double or triple their intake of fluid to offset the dehydration that results from breathing deeply the extremely dry air. The need for liquids grew constantly more pressing the higher we climbed. We carried powdered fruit juice to dissolve in our water to make it more palatable, and also drank large quantities of frozen fruit juice dropped later by plane.

After a bite to eat and some hot tea, I turned off the stove to save gasoline, even though the temperature was only 10° F. As

its roar died, I was instantly greeted by the gentle patter of snowflakes on the tent. In the total silence of the heights even leathery snowflakes make a perceptible sound falling on tent roofs. Poking my head out the drawstring entrance, I was astonished to see the rocky cliffs of McKinley quite clearly, with Kahiltna Valley visible downward for at least five miles. The sun had disappeared behind the clouds, but the long twilight of the Alaskan summer still lingered.

I boxed myself marking our little airport with all available dark objects. This is essential for landing a plane on snow when there is no sun, no shadow, and the visibility is poor. Otherwise, everything appears an even, shapeless white. All depth perception is lost, and as a pilot nears the ground he has nothing with which to gauge his height.

As the weather slowly cleared, I heard Terry faintly on my radio, talking in the Government station at Talkeetna, some 60 miles to the southeast: "This is N-1048-A," he was saying. "My position is now five miles north of Chelina Lake, heading

for camp on upper Kahiltna Glacier."

At 8:45 Terry's voice boomed out loud and clear: "N-1048-A to KAOB. Can you see or hear me? I'm flying through drizzling snow about five miles below your camp." He was on his way back with Henry Buechel.

I crawled out the door and looked down-glacier behind the tent. There he was. I could barely hear the plane's feeble little hum I reported. "Landing conditions marginal, falling 300-500 feet, absolutely calm. I've marked a runway."

Two minutes later the little craft roared over camp and came to a perfect landing.

This time the sky looked as if it were really going to snow in earnest. We unloaded Henry's gear in a jiffy, and with a cheery



Experiments in Reverse More Explains a Route Across an Ancient Pass

W. L. Hall, 1900, *Journal of the Western Ornithological Society*, 1: 10. (Type locality: Fort Huachuca, Pima County, Arizona. Subsequent records from Arizona: 1900, *Condor*, 10: 103; 1901, *Condor*, 11: 103; 1902, *Condor*, 12: 103; 1903, *Condor*, 13: 103; 1904, *Condor*, 14: 103; 1905, *Condor*, 15: 103; 1906, *Condor*, 16: 103; 1907, *Condor*, 17: 103; 1908, *Condor*, 18: 103; 1909, *Condor*, 19: 103; 1910, *Condor*, 20: 103; 1911, *Condor*, 21: 103; 1912, *Condor*, 22: 103; 1913, *Condor*, 23: 103; 1914, *Condor*, 24: 103; 1915, *Condor*, 25: 103; 1916, *Condor*, 26: 103; 1917, *Condor*, 27: 103; 1918, *Condor*, 28: 103; 1919, *Condor*, 29: 103; 1920, *Condor*, 30: 103; 1921, *Condor*, 31: 103; 1922, *Condor*, 32: 103; 1923, *Condor*, 33: 103; 1924, *Condor*, 34: 103; 1925, *Condor*, 35: 103; 1926, *Condor*, 36: 103; 1927, *Condor*, 37: 103; 1928, *Condor*, 38: 103; 1929, *Condor*, 39: 103; 1930, *Condor*, 40: 103; 1931, *Condor*, 41: 103; 1932, *Condor*, 42: 103; 1933, *Condor*, 43: 103; 1934, *Condor*, 44: 103; 1935, *Condor*, 45: 103; 1936, *Condor*, 46: 103; 1937, *Condor*, 47: 103; 1938, *Condor*, 48: 103; 1939, *Condor*, 49: 103; 1940, *Condor*, 50: 103; 1941, *Condor*, 51: 103; 1942, *Condor*, 52: 103; 1943, *Condor*, 53: 103; 1944, *Condor*, 54: 103; 1945, *Condor*, 55: 103; 1946, *Condor*, 56: 103; 1947, *Condor*, 57: 103; 1948, *Condor*, 58: 103; 1949, *Condor*, 59: 103; 1950, *Condor*, 60: 103; 1951, *Condor*, 61: 103; 1952, *Condor*, 62: 103; 1953, *Condor*, 63: 103; 1954, *Condor*, 64: 103; 1955, *Condor*, 65: 103; 1956, *Condor*, 66: 103; 1957, *Condor*, 67: 103; 1958, *Condor*, 68: 103; 1959, *Condor*, 69: 103; 1960, *Condor*, 70: 103; 1961, *Condor*, 71: 103; 1962, *Condor*, 72: 103; 1963, *Condor*, 73: 103; 1964, *Condor*, 74: 103; 1965, *Condor*, 75: 103; 1966, *Condor*, 76: 103; 1967, *Condor*, 77: 103; 1968, *Condor*, 78: 103; 1969, *Condor*, 79: 103; 1970, *Condor*, 80: 103; 1971, *Condor*, 81: 103; 1972, *Condor*, 82: 103; 1973, *Condor*, 83: 103; 1974, *Condor*, 84: 103; 1975, *Condor*, 85: 103; 1976, *Condor*, 86: 103; 1977, *Condor*, 87: 103; 1978, *Condor*, 88: 103; 1979, *Condor*, 89: 103; 1980, *Condor*, 90: 103; 1981, *Condor*, 91: 103; 1982, *Condor*, 92: 103; 1983, *Condor*, 93: 103; 1984, *Condor*, 94: 103; 1985, *Condor*, 95: 103; 1986, *Condor*, 96: 103; 1987, *Condor*, 97: 103; 1988, *Condor*, 98: 103; 1989, *Condor*, 99: 103; 1990, *Condor*, 100: 103; 1991, *Condor*, 101: 103; 1992, *Condor*, 102: 103; 1993, *Condor*, 103: 103; 1994, *Condor*, 104: 103; 1995, *Condor*, 105: 103; 1996, *Condor*, 106: 103; 1997, *Condor*, 107: 103; 1998, *Condor*, 108: 103; 1999, *Condor*, 109: 103; 2000, *Condor*, 110: 103; 2001, *Condor*, 111: 103; 2002, *Condor*, 112: 103; 2003, *Condor*, 113: 103; 2004, *Condor*, 114: 103; 2005, *Condor*, 115: 103; 2006, *Condor*, 116: 103; 2007, *Condor*, 117: 103; 2008, *Condor*, 118: 103; 2009, *Condor*, 119: 103; 2010, *Condor*, 120: 103; 2011, *Condor*, 121: 103; 2012, *Condor*, 122: 103; 2013, *Condor*, 123: 103; 2014, *Condor*, 124: 103; 2015, *Condor*, 125: 103; 2016, *Condor*, 126: 103; 2017, *Condor*, 127: 103; 2018, *Condor*, 128: 103; 2019, *Condor*, 129: 103; 2020, *Condor*, 130: 103; 2021, *Condor*, 131: 103; 2022, *Condor*, 132: 103; 2023, *Condor*, 133: 103; 2024, *Condor*, 134: 103; 2025, *Condor*, 135: 103; 2026, *Condor*, 136: 103; 2027, *Condor*, 137: 103; 2028, *Condor*, 138: 103; 2029, *Condor*, 139: 103; 2030, *Condor*, 140: 103; 2031, *Condor*, 141: 103; 2032, *Condor*, 142: 103; 2033, *Condor*, 143: 103; 2034, *Condor*, 144: 103; 2035, *Condor*, 145: 103; 2036, *Condor*, 146: 103; 2037, *Condor*, 147: 103; 2038, *Condor*, 148: 103; 2039, *Condor*, 149: 103; 2040, *Condor*, 150: 103; 2041, *Condor*, 151: 103; 2042, *Condor*, 152: 103; 2043, *Condor*, 153: 103; 2044, *Condor*, 154: 103; 2045, *Condor*, 155: 103; 2046, *Condor*, 156: 103; 2047, *Condor*, 157: 103; 2048, *Condor*, 158: 103; 2049, *Condor*, 159: 103; 2050, *Condor*, 160: 103; 2051, *Condor*, 161: 103; 2052, *Condor*, 162: 103; 2053, *Condor*, 163: 103; 2054, *Condor*, 164: 103; 2055, *Condor*, 165: 103; 2056, *Condor*, 166: 103; 2057, *Condor*, 167: 103; 2058, *Condor*, 168: 103; 2059, *Condor*, 169: 103; 2060, *Condor*, 170: 103; 2061, *Condor*, 171: 103; 2062, *Condor*, 172: 103; 2063, *Condor*, 173: 103; 2064, *Condor*, 174: 103; 2065, *Condor*, 175: 103; 2066, *Condor*, 176: 103; 2067, *Condor*, 177: 103; 2068, *Condor*, 178: 103; 2069, *Condor*, 179: 103; 2070, *Condor*, 180: 103; 2071, *Condor*, 181: 103; 2

Sept 11, 1944. Leroy was off again into the bush and again thirty minutes later we heard a report that he was passing the land at Chokoma. Without his skill and determination as a bush pilot we could not have been where we were.

Weather-bound on a Glacier

The weather closed in tight, and Jim Gale and I, the pilot, were scared. But Chelton's engine kept going and I flew in, the last four minutes at a terrific rate. Dr. John Ambler, Dr. Melvin Arnold, Jerry, Mary, and Harry Jackson were in for Mr. & Mrs. Ross, taking from a messenger Mr. Knickerbocker's name, and arrived in the morning. The next day they were to drive to Waukegan, on the opposite side of the peak from us.

While our 4-man team was working on the main base camp, I went to a small base camp on the west side of the mountain to meet the other two teams. The mountain is being taken from the north, studying the way the ice they progressed. They planned to meet and

1. *Journal of June 5* pages 23 and 24

Mohegan stone is a hard but brittle variety of granite, which cooled into place in the form of a hot molten form. It then cooled to form a brittle rock, crystalline rock, finally. The surface is a erosion of the rock. Some time ago, the first the point where the modern material is an overlying layer of material, and on the bottom is a patch of rock.

For the last 10 years, the MK's have further deteriorated and they are the only representative of the times and the place that built the foundation of the Party. The new uplifts, no one knows.

How Safe is Bifenthrin?

For the next Kahuling Valley was buried beneath a dense forest of towering trees. Then the trees stood abruptly and Fair Moore made two more short runs to our tiny little camp, bringing a few more of Bill Hackett's gear. (page 27)

What he was worried about was that the "red" in the word "socialism" was not a red.



glance at Kaituma this morning. We were not alone in this view. A man on a horse was on the snow-covered saddle.

Even at a distance the northern sky was still a deep red. The snow was still falling. The shovels digging a line here and there in the snow were not out of sight. We were out of sight of the summit of McKinley. We were nearly within of the West. The snow was so near that the McKinley's summit was still higher and more distant.

The mountain was a great one. Not a shadow of the light except the snow and the snow. The snow was so near that the McKinley's summit was still higher and more distant. On our first call we picked up the CAA station at Talkeetna, to which we had sent a man to the house at Mount McKinley. The snow was so near that the McKinley's summit was still higher and more distant. It was a great one. We knew that our first call was assured of a response from the world.

We asked Talkeetna to release the 10th Key.

Surveying in the Snow Is No Joke

The snow was so near that the McKinley's summit was still higher and more distant. It was a great one. We knew that our first call was assured of a response from the world. We asked Talkeetna to release the 10th Key. The snow was so near that the McKinley's summit was still higher and more distant. It was a great one. We knew that our first call was assured of a response from the world.

one Squadron of the Alaskan Air Command in Anchorage. Tell them, we said, that our weather was perfect for the prearranged aerial drop of the equipment we had left with them.

Scarcely had we crawled into our sleeping bags, it seemed, when a distant hum awakened us. It was 6:30 in the morning, the sun was high in the cloudless sky, and there, down the valley, was the approaching Air Force plane.

Jim turned on the radio and at once picked up a voice: "Air Rescue to KW034. . . Calling camp on Kahiltna Glacier. . . Are you reading our signal?"

"KW034 to Air Rescue," he replied. "We're reading you loud and clear."

Jack came the voice from the plane: "We'll be over you in about two minutes. Give us a call after we have finished the first drop and report how we did."

Supplies Hit Wrong Target

As the big C-47 roared down only 200 feet above us, the pilot somehow missed the red cloth marker laid out on the snow 100 yards away. We realized with sudden horror that bundles and boxes flying out the open cargo door were streaking directly for our tent! They showered around it, one making a deep crater less than five feet from the tent in which Jim Gile was taking on the radio. It was his own bag of personal equipment!

This near tragedy was over so quickly we scarcely realized what had happened. As the plane disappeared over the pass, Jim was yelling into the radio, "Hey, for heaven's sake, watch where you're throwing that stuff! I know it at the marker, not the tent!"

"Mighty sorry, fellows," came the reply as the plane circled beyond the pass and flew back toward us. "We see the marker now. It won't happen again."

This time supplies came thudding down at a safe distance: tent poles, survey markers, a fresh king salmon, nylon rope, tent pegs, larch-wood trail markers, extra clothes, tents, and sleeping bags. Then came five bags of breakable supplies by parachute: radio batteries, film, an alarm clock, stove, gasoline, survey gear, even a small plywood sled.

It had been a breath-taking half-hour. We had not yet had breakfast, but more than a ton of supplies had already been delivered at our front doorstep from a warehouse 130 miles away. In the old days it would have taken a 20-horse pack train and three winterers weeks to move this load from Anchorage to the lower end of the Kahiltna Glacier, 44 miles below our camp. From there to where we sat it would have been such a prodigious job of man-k packing to move these same supplies that we shuddered even at the thought.

Included in the equipment dropped to us

were 500 pounds of Birdseye frozen foods, which we promptly buried in a natural deep-freeze cave just outside our front door. Forty-eight loaves of bread, each packed in a paper bag, rained down all over our "lawn"; they too were buried and frozen. We took loaves to bed with us when we wanted to thaw them out. On the trail we often carried small cans of frozen meat inside our clothing to thaw them for lunch.

Fats Indigestible at Altitude

Our diet was strong in protein, which we got from lean frozen handburg and ham. An ample supply of fresh vegetables and fruit helped us forget the almost total lack of fat in our diet at the highest camps. This was important to our efficiency on the mountain for decrease in oxygen above 15,000 feet causes great difficulty in digesting fats.

Members of the Parker-Barnes expedition of 1912, not realizing this, took quantities of pemmican, rich in energy but also very fatty. This diet caused them such acute distress above 15,000 feet that they could scarcely eat, lost strength, and unhappily had to turn back in a heavy storm only a few hundred feet from McKinley's top.

A few days after the supply drop we all set out to scale previously unclimbed "Peak Z," a snow dome that rose southwest of camp. It was an easy climb up a rounded ridge buried under hundreds of feet of perpetual ice and snow. On top we built an igloo a few yards from our survey instrument so we could dodge in for shelter and a cup of hot tea when our fingers grew too cold to work the theodolite (page 227). Meanwhile, however, it grew absurdly warm, 40° F. in the sun, and we actually worked in our shirt sleeves.

Jets Play Hide-and-Seek

As we busied ourselves reading angles on the instrument, I heard a curious swooshing sound far off toward Mount McKinley. Above the top of the great peak several tiny silver discs were playing hide-and-seek against the deep-blue sky. Then another appeared, and another and another, till we counted 10 little specks. They were jet fighter planes from Anchorage taking afternoon exercise above the monarch of North America (page 240).

As we stood watching this extraordinary show, I was reminded of John Gillespie Magee, Jr.'s inspiring poem, *High Flight*:

I've . . . wheeled and soared and swung
High in the sunlit silence. High, far above them,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air
I've topped the wind-swept heights with new grace
Where never lark, or even eagle, flew . . .

Two of the planes left the others and dived

toward us at terrific speed. I took out a pocket mirror and flashed it as they swept by a mile or two away. One of the lead planes turned toward us, and I flashed him again as he passed between the man and us. He wobbled his wings slightly, then headed away for a minute, apparently talking to his companion by radio.

Planes Buzz Camp at 600 Miles an Hour

Climbing almost out of sight, they turned lazily and headed back. Approaching at a staggering speed—probably 600 miles an hour or more—they screamed over us scarcely 100 feet above our heads. We could clearly see the pilots waving.

Gracefully they swung upward to the east. Barely a minute later they had regained their comrades, seven miles away and more than 8,000 feet above us. That effortless minute's climb was soon to take us seven days and nights of nearly constant toil.

As the afternoon wore on, black thunderheads over the lowlands to the north began to rumble ominously, and we saw gray streamers of rain pouring down beneath them into the darkened valleys below. A breeze broke the stillness, and, our survey done, we hesitated in front of the igloo, worried lest the storm catch us during our descent.

The breeze grew to a wind, the wind to a gale, and then the storm hit us with terrific violence. We were far above the lightning and rain, but the crest of the turbulent mass of cloud hung a furious blizzard at us. We retreated into our igloo and at the very height of the howling tempest enjoyed a tranquil afternoon tea.

An igloo is a wonderful shelter. It's cool and shady on a sunny day; warm, cozy, and quiet in the wildest storm; and it doesn't flap in the wind. Constant flapping of our tents at night on previous trips had caused us to lose many hours of much needed sleep.

For an hour and a half the blizzard buffeted our retreat. Then, as suddenly as it came, the great cloud detached peacefully off, the sun burst out, and the wind died down to a gentle breeze.

Quiet Beauty Follows Blizzard

As we started homeward, the fresh snow glittered all about us. Evening shadows reached across the western buttresses. To our left the emerald lowlands twinkled with myriads of tiny lakes and streams reflecting the low rays of the sun. In the distance we could hear occasionally the rumble of avalanches.

At base camp we spent several days in survey work for the new map of McKinley. This map began to take shape in 1945 during World War II, while I was a member of an Army Air Forces expedition on some of the

peaks near McKinley. There we tested emergency food, shelter, and clothing for use in the Arctic. To help pass the time, we had our supply plane drop us a surveyor's transit to measure the angles between a number of points and to determine locations and heights of many unmapped peaks.

Two years later, in 1947, RKO Radio Pictures, Inc., asked Boston's Museum of Science to help obtain motion pictures of mountain scenery at high altitudes on Mount McKinley for use in a forthcoming film. At the same time they agreed to support our survey program and other scientific work there.

In cooperation with us, an Air Force B-29 made vertical mapping photographs of the entire area from 32,500 feet, while we did ground survey work on McKinley's upper slopes to tie the pictures together. The U. S. Coast and Geodetic Survey lent us two powerful Zeiss theodolites.

Surveying from McKinley's North and South Peaks had been no joke. On the South Peak it was 20° below zero. Often a gust of wind bumped my face against the theodolite eyepiece. Then I had to carry out the observation all over again after making sure the instrument had not been thrown out of level and position.

Surveying on Brink of Disaster

The North Peak culminated in a narrow point of snow where there was barely room to clear away a level triangle three feet on a side to set up the theodolite. One careless step would have plunged me down the frightening Wickersham Wall, 14,000 feet high.

In aerial mapping, two pictures of the same area are taken a few seconds apart. Viewed through a stereoscope, they appear as one, in three dimensions, with slopes, heights, and depths so vividly evident that accurate contour lines can be drawn directly from the photographs.

Using all available data to fix positions and altitudes, and stereoscopic pictures for topography, the U. S. Geological Survey mapping office at Denver, Colorado, produced a map on a scale of 3.9 miles to the inch. The data to be obtained by the U. S. Coast and Geodetic Survey and a new Museum of Science party during 1953, with that gathered during our 1951 climb, will provide information for several miles-to-the-inch quadrangle maps. Some of this mapping has already been done, and about 120 square miles of the central portion are shown on the map accompanying this article (pages 236-237).

No complete large-scale map of Mount McKinley has ever been made before.

On the evening of June 30, while we were returning from a reconnaissance of McKinley's



One Dashover No Fail, Low-cost Hauling Carries Pay for Mountain Explorers

THESE MEN, who have been making a name for themselves in the world of mountaineering, are now making a name for themselves in the world of business. They have discovered a new way to haul supplies up the mountain, and they are making a fortune out of it.

As dawn was breaking, two Indians were approaching our camp. They were followed by another pair of dogs inched over the crest of Kaktovik Pass and started down the steep fall into camp. Our other four companions had arrived.

An hour later we were seated in and found a hot dinner already on the stove. It was actually only a few days since we had been told that Jerry and Barry had somehow it seemed as if we had been separated for months.

They had been separated by an enormous land storm, plagued by swarms of blood-thirsty mosquitoes and had almost a complete loss of their supplies. As a result they had to take a long, hard journey to get to camp. They had been on the summit of Mount McKinley for the first time in history.

Letter from Boston Only 3 Days Old

Two days later Jerry Moore landed at our 10,000-foot high camp and taxied off the "airstrip" right up to the cook tent with mail, food, and other supplies; one of the letters had been mailed in Boston only three days

before. This was the first airplane landing ever made in Alaska up to that moment.

As it turned out, it was safe enough for Jerry to have landed here instead of lower on the mountain at the first place. But, not having any food or conditions at the pass, we delayed it all.

Ferry landed while we read our mail and found a letter from Jerry and Barry. He had been "killed" by the mosquitoes and had to take a long, hard journey to get to camp. He had been on the summit of Mount McKinley for the first time in history.

His meeting with the men was a great one. He had been on the summit of Mount McKinley for the first time in history. He had been on the summit of Mount McKinley for the first time in history.

Food sorted, survey work completed, and the party reunited, we focused our attention on Mount McKinley. The route by which we intended to breach its western barrier started just behind our camp.

We had carefully planned it to avoid huge crevasses and avalanches, the two major dangers of the old route up the other side of the

mountain. At first we followed the bottom of a broad hollow filled with hundreds of feet of drifted, wind-packed snow. When a big crevasse began to block our way, we climbed sharp slopes to the crest of the ridge which paralleled our route to the left.

Actually we encountered only two crevasses, small in comparison to those on the northeast approach. Above, the grade was not steep, but in one place we struck a patch of blue-green ice as slippery as an inclined skating rink and had to take off our snowshoes and strap on iron creepers, or crampons.

Three thousand feet above camp these snow-and-ice slopes ended abruptly in a massive granite shoulder that rose with dramatic steepness 3,000 more feet to the 16,000-foot crest of McKinley's great West Butte.

Here, in the very shadow of the cliff, we set up our first advanced camp. We had reconnoitered this route and marked it with birch woods stuck in the snow several days before. The entire 8-man party tackled it for the first time with 60- to 90-pound packs on the Fourth of July.

A Night at "Windy Corner"

As we struggled up to our camp site late that afternoon, the wind howled through the granite ledges at our feet. The sky was gray with lowering mist. A sea of clouds filled the valleys below, and snowflakes were already beginning to fall. That night five of us stayed at "Windy Corner," as we called it.

Mel, Darry, and Jerry returned to base camp after hauling up three loads of equipment. For the next week they would continue Mel's geologic exploration several thousand feet below us, around the base of the upper peak.

Camp was set on the snow about 100 feet from the rocky crest of Windy Corner so we could find snow blocks for building an igloo and a windbreak wall to protect our cook tent. We built a long tunnel entrance on the lee side of the igloo to help keep out the wind.

There is no real shelter anywhere on this west side of McKinley. The big storms are almost always southwesterers, which originate out toward the tip of the Aleutian Islands and strike the peak with tremendous violence. This route has one advantage, however: buffeting winds were at our backs instead of cutting our faces, as they do on the northeast side.

After a cozy, peaceful night in our igloo, where our body heat and breathing kept the inside temperature up nearly to freezing, we had a real job digging our way out to breakfast. The entrance to our tunnel was drifted in solid with fresh snow.

From our snug and calm shelter we emerged into a roaring storm, with 60-miles-per-hour gusts, dense fog, and a wild blizzard. It took an

hour to excavate the half-buried cook tent, relighten the guy ropes, and get inside.

As John Ambler crawled into the tent, his beard white with frost and icicles, he said with some disgust, "This kind of climbing is about 90 percent trying to stay alive and warm, and only 10 percent climbing!"

Gale Howls 80 Miles an Hour

A storm of increasing violence lashed camp all that day. We ventured out in relays during the afternoon and built another igloo, connecting it to the first one by a snow doorway. By supper time the gusts were hitting 80 miles an hour (measured by anemometer), and the temperature was down to 14° above zero. Snow fell so thickly we could not see a thing. Luckily, it was blowing so hard the snow could not accumulate. It simply whirled off out of sight into the valley over the 2,000-foot cliff in front of camp.

On July 6 the wind died down and the skies cleared rapidly. This day and the next we carried a week's supplies up to 14,000 feet, along a broad, gently sloping snow shelf at the side of the cliffs.

Climbing higher, we tied knotted rope around our snowshoes to keep us from slipping backward on the steepening slope. Jim and I started ahead of the others and rapidly got into trouble. Here the snow from the recent storm lay drifted deep all up the hillside.

At first we made fair headway with our 60-pound packs, but then we began to slide backward several inches at every step. I took off my snowshoes and promptly broke through the crust up to my waist. I put them on again, took the shovel out of my pack, and started carving large flat steps ahead of us.

Then, at 15,000 feet, the slope steepened again and the surface snow was crusted just enough so that snowshoes would not hold on it. The spot where we wanted to make our next camp was still 1,000 feet above.

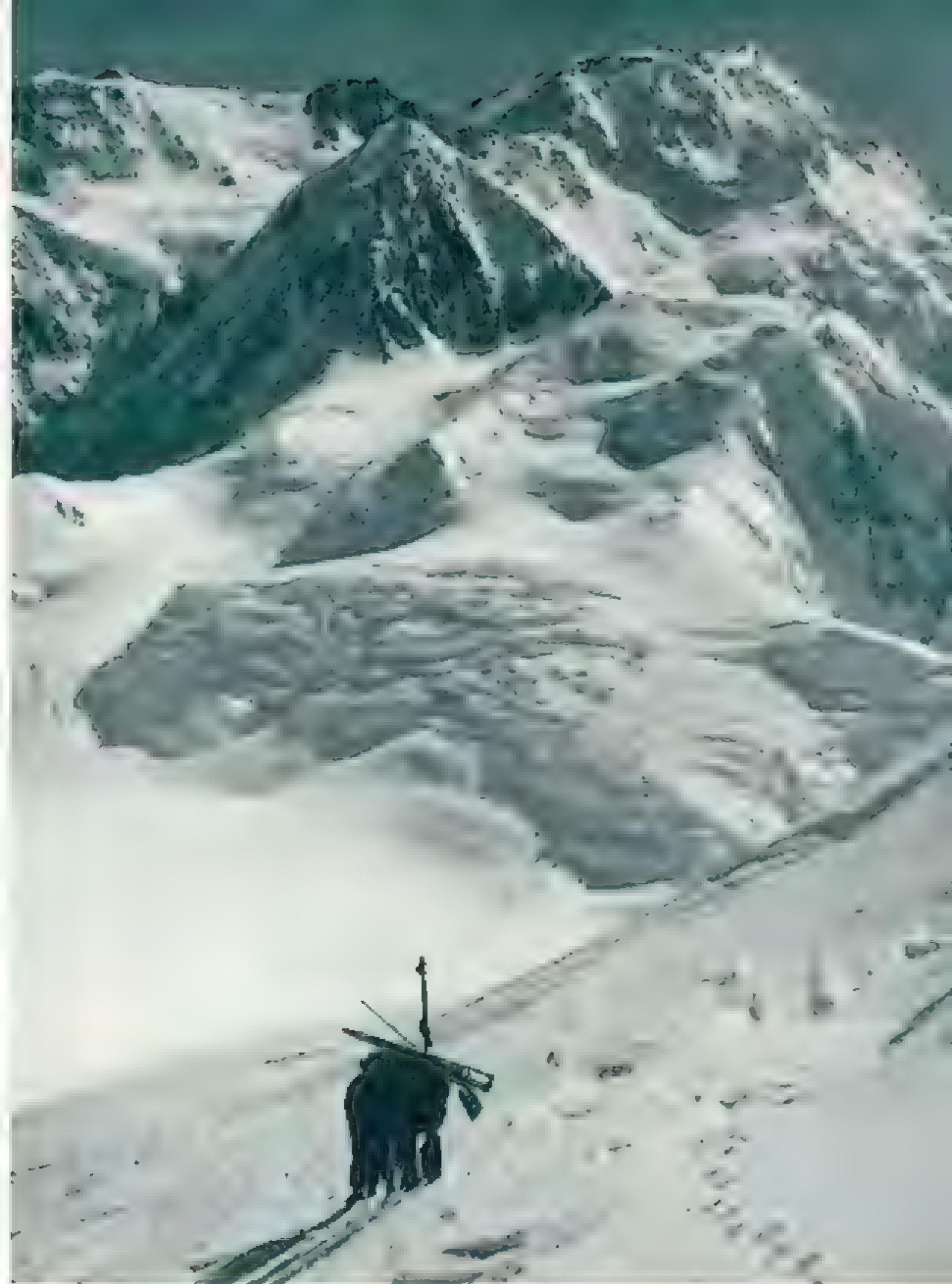
Digging a Path with Shovels

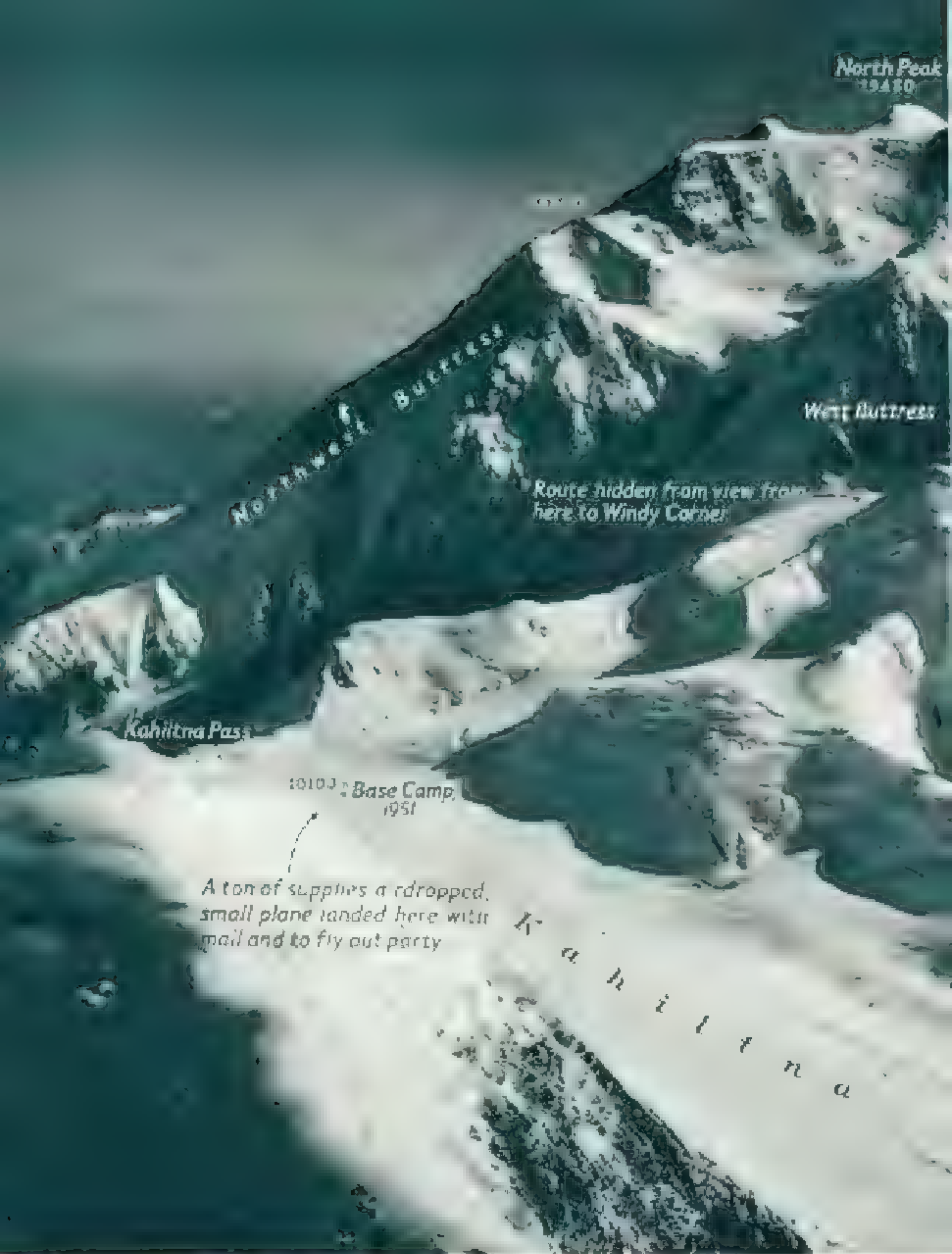
We had only two choices: wait two or three days until wind and cold hardened the slope so we could walk on it without snowshoes, or shovel a trail up the mountainside to an ice shelf about 400 feet above. Our time was running short, and, also, it might snow again. We chose to shovel.

When I got so tired I couldn't lift another shovelful, Jim took a turn at it. After an hour's work I looked back at my pack: it was only 100 feet behind us.

In another hour conditions began to improve. After that grueling uphill struggle we walked and slid back to our packs in about three easy minutes. We reached the 15,400-

(Text continued on page 245)

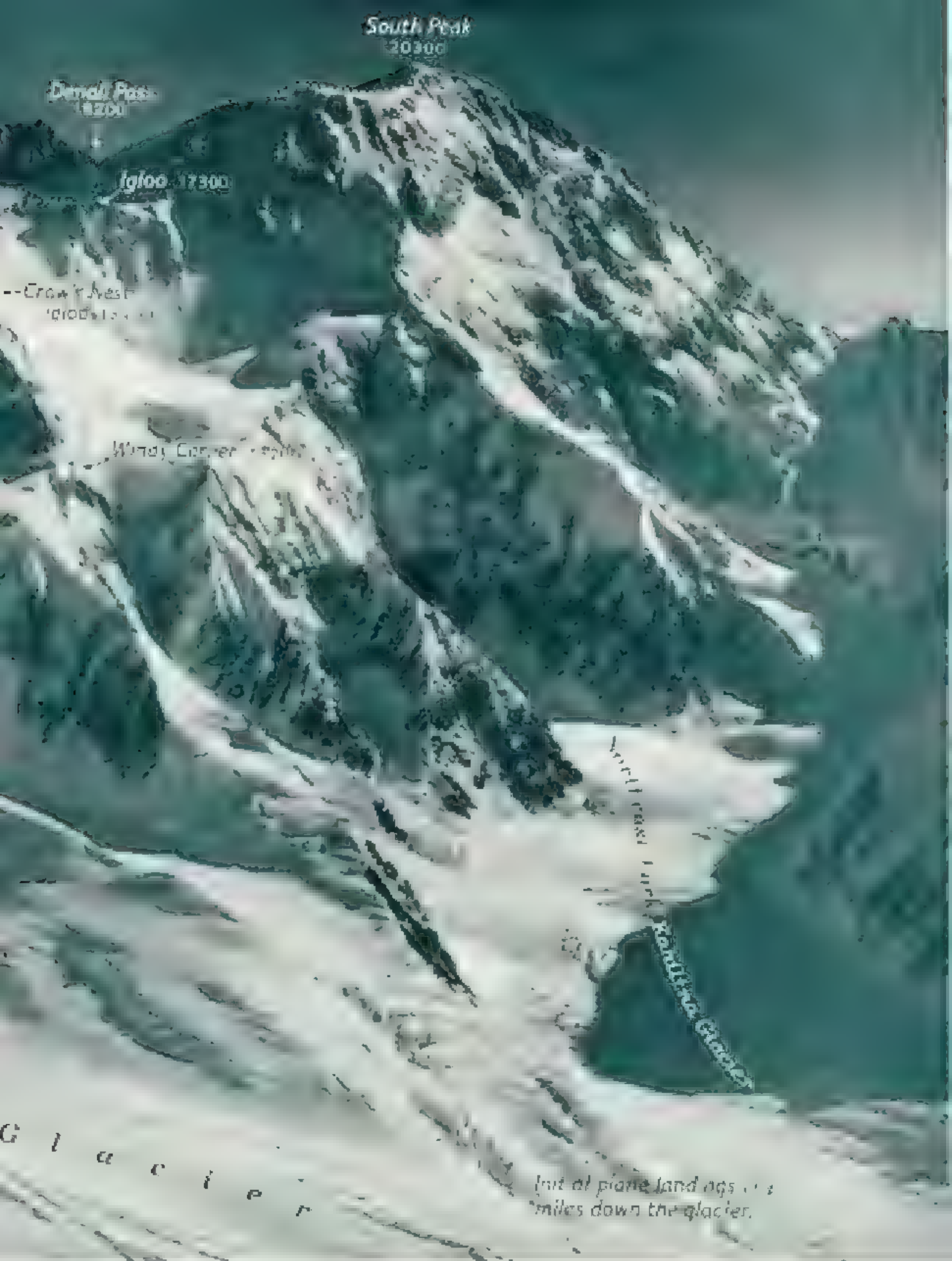




20

Mountain Climbing by Air: an Innovation of the Author's 1951 Ascent

A small plane used the author's trail on the snow- and ice-covered mountain. The plane was used to drop supplies and to fly out party. The plane was used to fly out party. The plane was used to fly out party.



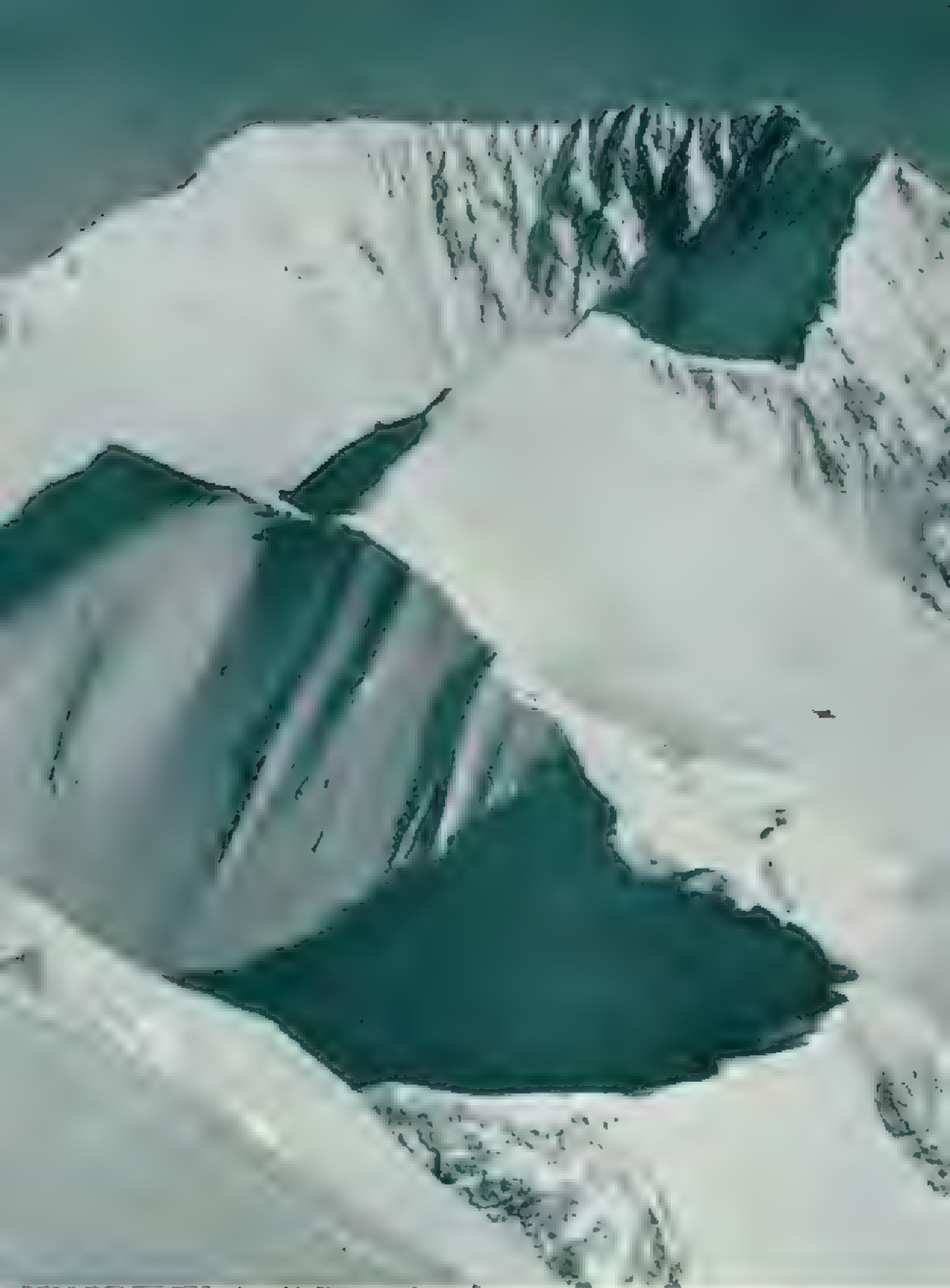
Mount McKinley's South Peak Provides a Favorable Site for Cosmic Ray Studies

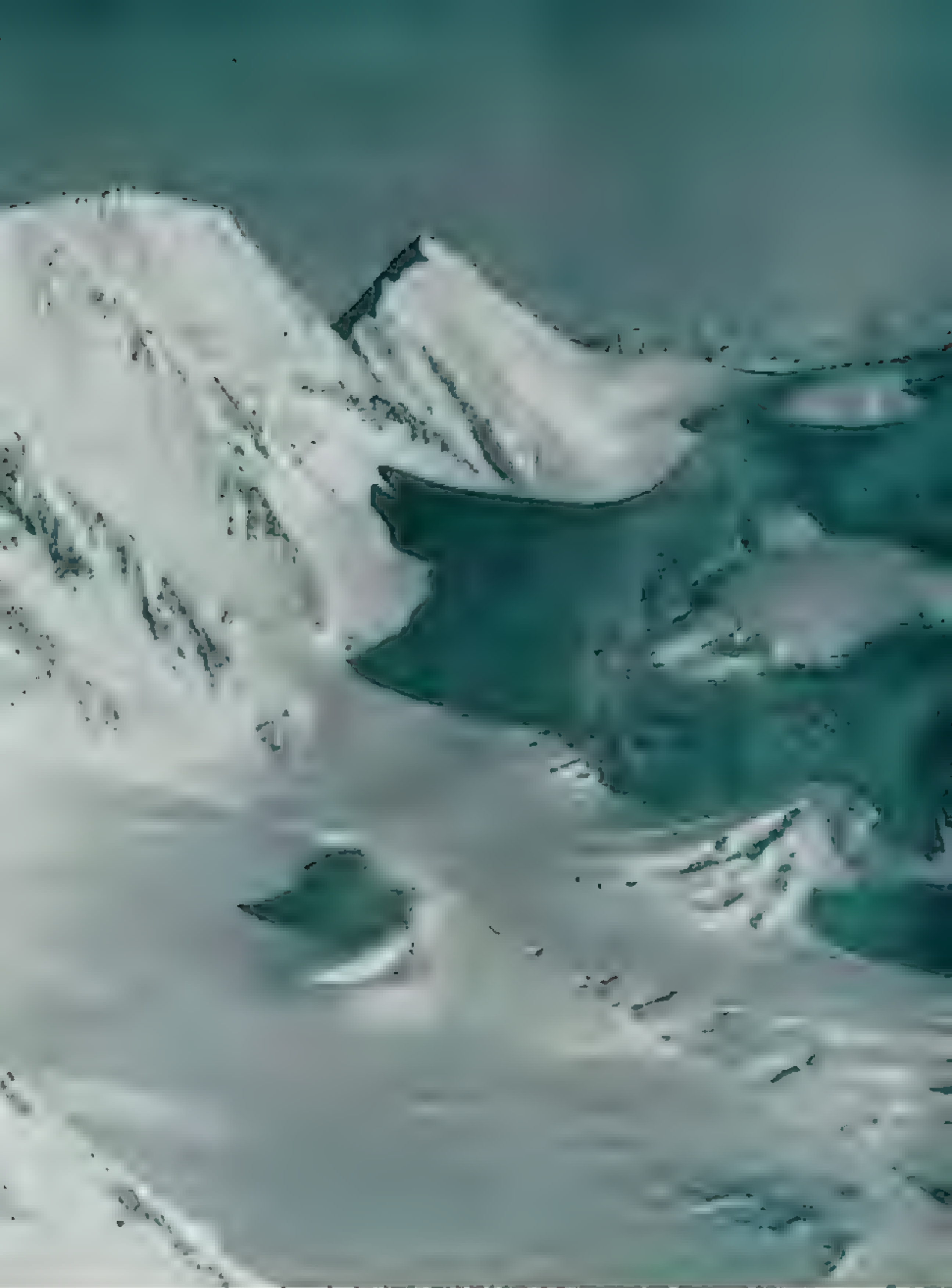
Very little snow covered the summit of the mountain, and the few clouds which were present did not obscure the view of the surrounding country. The top of the mountain was very rocky and the snow was very thin and patchy.

United States Parks and Game Warden

The United States
 Department of the Interior
 Bureau of Land Management
 Washington, D. C.
 The following is a list of
 the National Parks and
 Game Warden in the
 United States. The list
 is arranged in alphabetical
 order of the name of the
 park. The name of the
 warden is given in
 parentheses after the
 name of the park. The
 location of the park is
 given in parentheses
 after the name of the
 warden. The list is
 arranged in alphabetical
 order of the name of the
 park. The name of the
 warden is given in
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 location of the park is
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 warden.

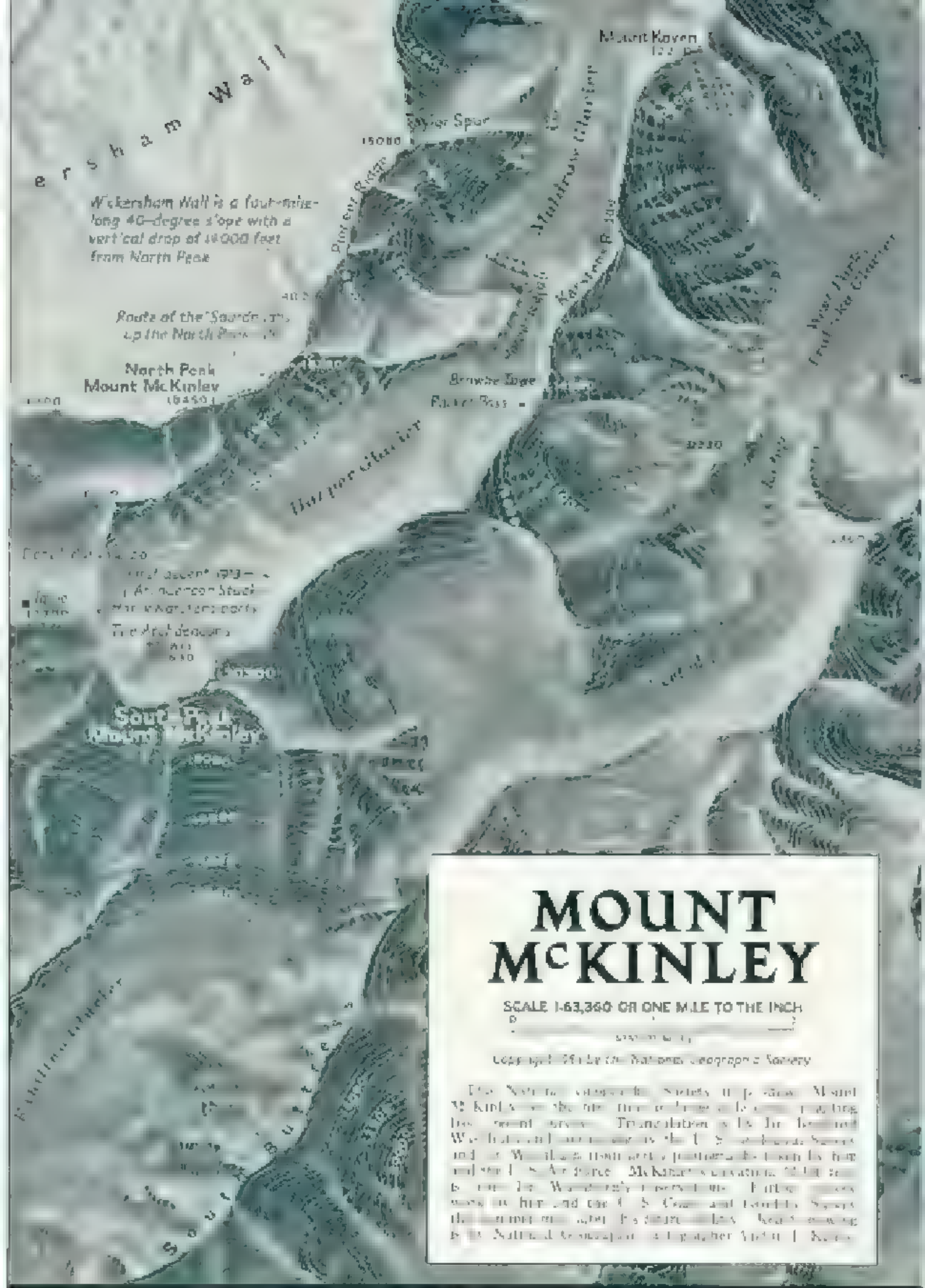






No Place for a Mistake on These High, Snowy Slopes. It's a Long Way Down!

It is hard to find a place to stop on the steep, snow-covered slopes of the high mountains. The steep, snow-covered slopes of the high mountains are a dangerous place to be. The steep, snow-covered slopes of the high mountains are a dangerous place to be.



MOUNT MCKINLEY

SCALE 1:63,360 OR ONE MILE TO THE INCH

Copyright 1913 by the National Geographic Society

The National Geographic Society has published Mount McKinley as the first of a series of maps showing the mountain service. The publication is by the National Geographic Society and is the first of a series of maps showing the mountain service. The publication is by the National Geographic Society and is the first of a series of maps showing the mountain service. The publication is by the National Geographic Society and is the first of a series of maps showing the mountain service.

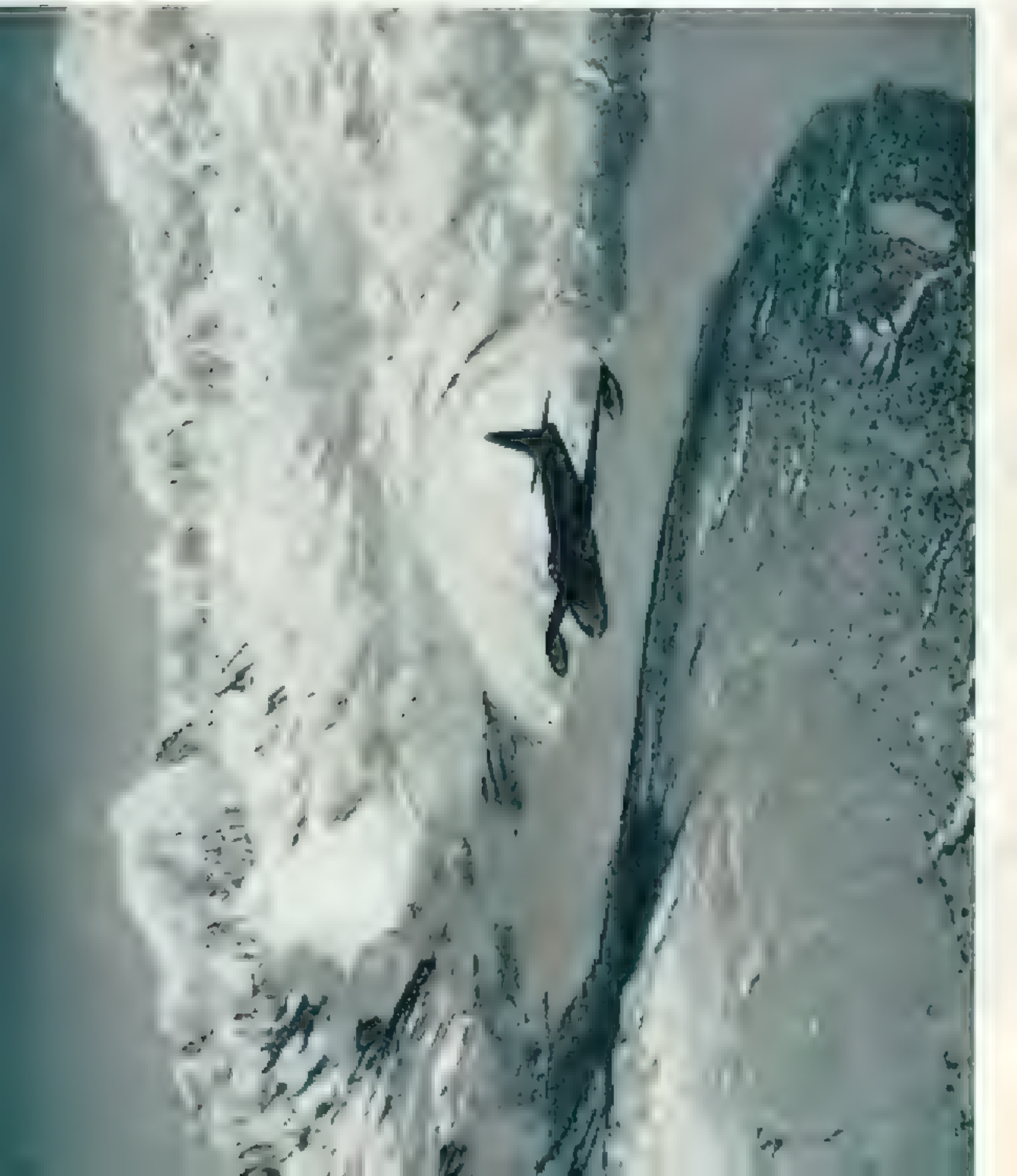


Aerial Navigation Airplane Experiments

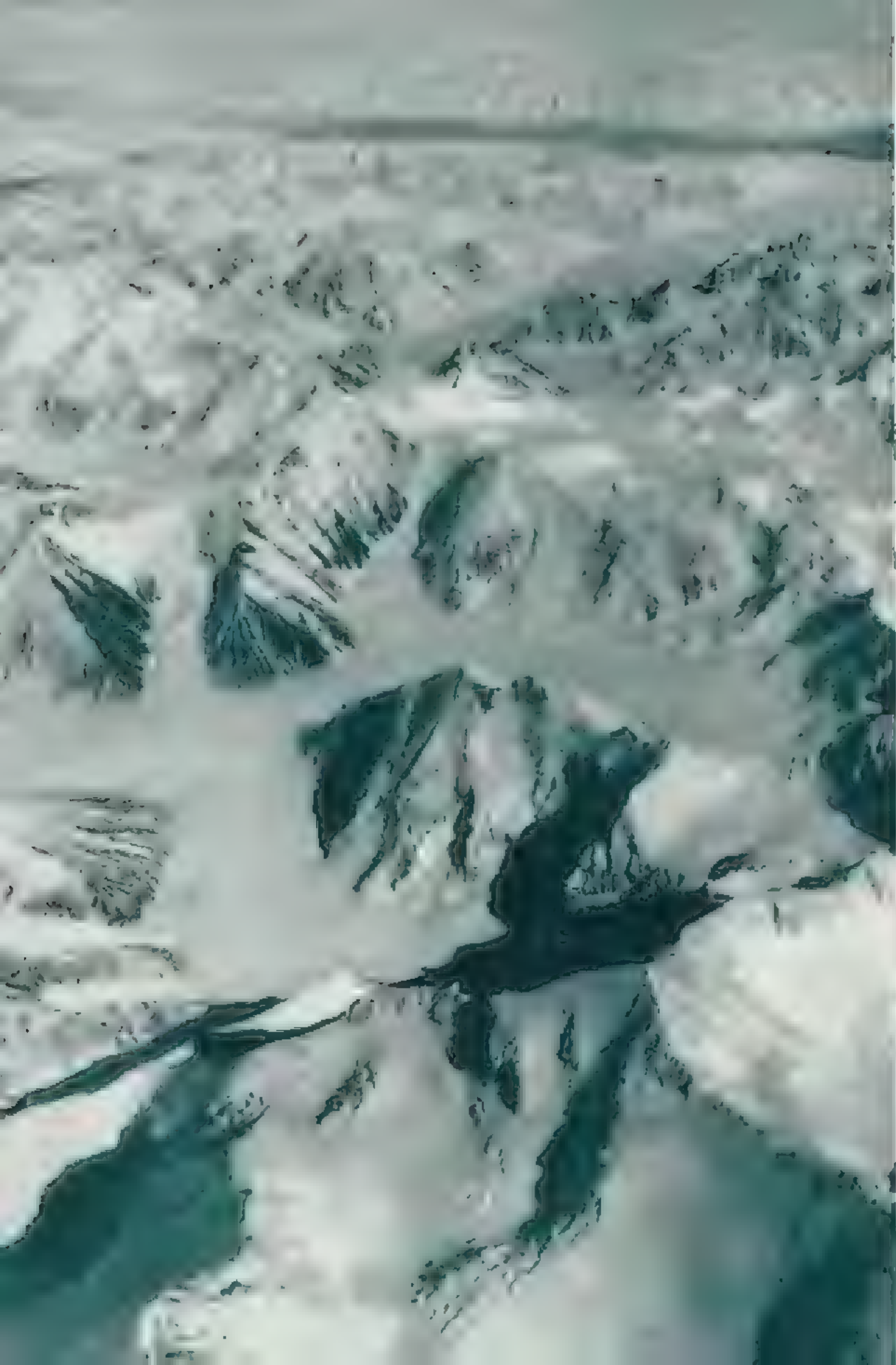
In an hour or so, the
 airplane was ready to
 go. With the pilot in
 the seat, the engine was
 started, and the plane
 took to the air. The
 first trial was a short
 hop of about 100 feet.
 The second trial was a
 hop of about 200 feet.
 The third trial was a
 hop of about 300 feet.
 The fourth trial was a
 hop of about 400 feet.
 The fifth trial was a
 hop of about 500 feet.
 The sixth trial was a
 hop of about 600 feet.
 The seventh trial was a
 hop of about 700 feet.
 The eighth trial was a
 hop of about 800 feet.
 The ninth trial was a
 hop of about 900 feet.
 The tenth trial was a
 hop of about 1000 feet.

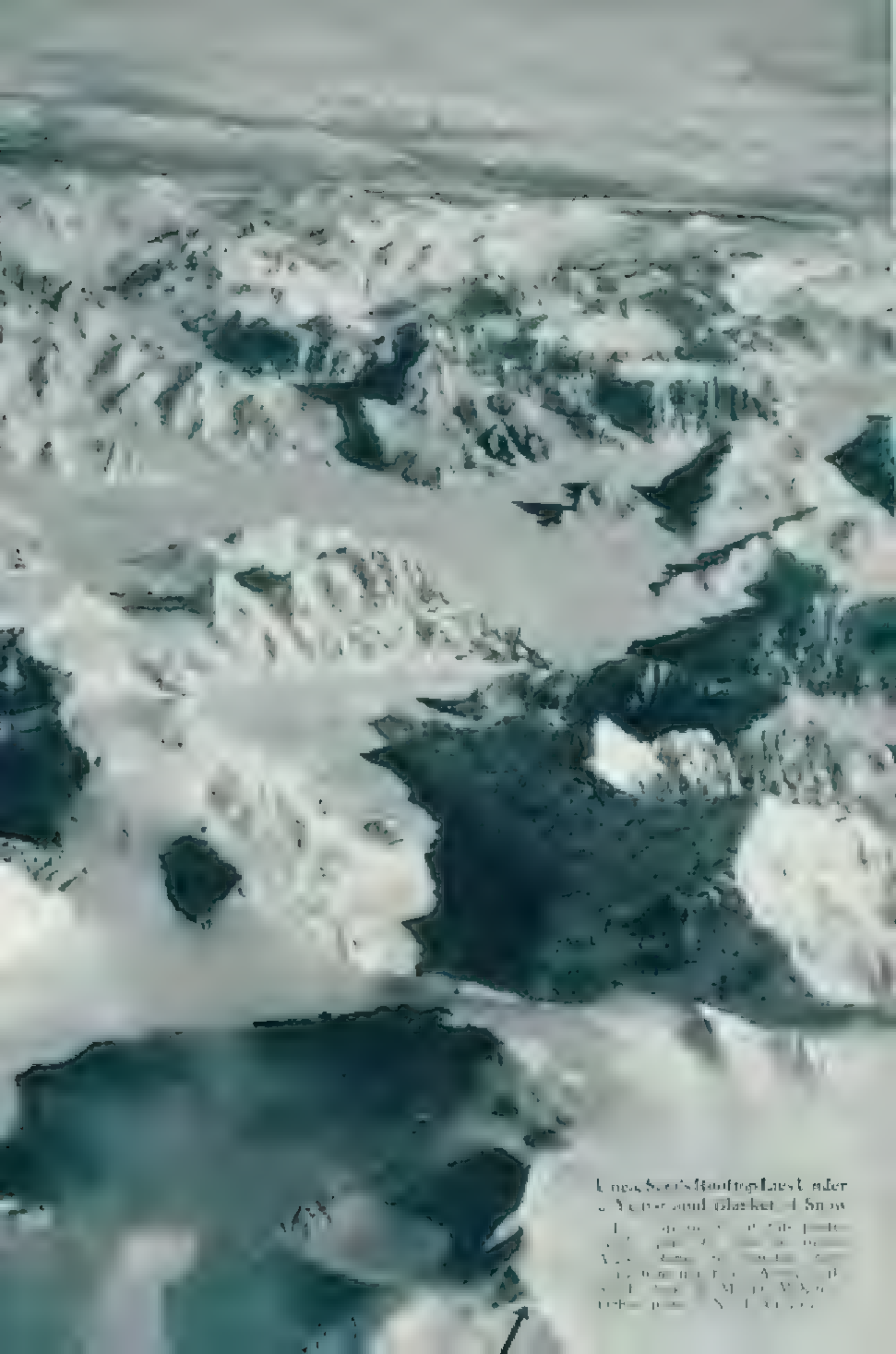
The

The first hop was a
 hop of about 100 feet.
 The second hop was a
 hop of about 200 feet.
 The third hop was a
 hop of about 300 feet.
 The fourth hop was a
 hop of about 400 feet.
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 hop of about 500 feet.
 The sixth hop was a
 hop of about 600 feet.
 The seventh hop was a
 hop of about 700 feet.
 The eighth hop was a
 hop of about 800 feet.
 The ninth hop was a
 hop of about 900 feet.
 The tenth hop was a
 hop of about 1000 feet.









King's Seaside, New Jersey, under
a heavy blanket of snow.
The snow is so deep that the
trees are almost buried.
The snow is so deep that the
trees are almost buried.
The snow is so deep that the
trees are almost buried.
The snow is so deep that the
trees are almost buried.



241

To Weary Climbers This Slope Was "Slippery as Greased Glass"

As Led by the New Mount McKinley Expedition, the Great One helped Hunter and his men on the first ascent of the mountain. — *North American*

foot shelf at 2:45 p.m., utterly exhausted and dripping with perspiration.

Up there, three miles above the sea, we began to feel the insidious effects of anoxia, or deficiency of oxygen. Anoxia increasingly impairs a climber's judgment, alertness, and will power the higher he gets. He becomes apathetic, careless, and tends to put off doing important tasks or does them sloppily. Worst of all, though he may be in a desperate state, he is convinced that he himself is perfectly normal.

Oxygen Lack Causes Errors

Once in 1947, when an Air Force plane dropped a load of supplies to us, I told them on radio that everything had landed all right. Actually one important box had smashed; anoxia had made me too careless to walk around and check everything.

Our writing became less legible, and we began to make elementary errors in arithmetic. For this reason we carefully double-checked our surveying figures. Once, because of anoxia, we set up the theodolite tripod so high I had to stand on tiptoe to see through it. And anoxia made me so apathetic that I used it in that awkward position and made several silly errors, which fortunately were corrected later.

Anoxia's ill effects can be reduced if a climber works slowly and rhythmically, without wasting energy. If, carrying a heavy pack, he chances to stumble, it is often better for him to go ahead and fall than to expend strength in a stubborn effort to retain his footing. There is no known cure for anoxia except bottled oxygen, which is far too heavy and clumsy to use on McKinley.

So perfect was the weather that after a good lunch we goaded ourselves into action and tackled one of the real enigmas of McKinley's west face—the last steep slope leading to the crest of the West Buttress. It rose directly 600 feet above our shelf at an average angle of more than 60° (measured by clinometer).

The final obstacle, now also clearly in sight, was the broken, rocky crest of the ridge leading from the top of the 16,000-foot shoulder to a broad snow plateau at 17,000 feet. From there to the summit aerial photographs clearly showed no unusual difficulties; simply 3,100 feet of steep, wind-packed snow slopes.

The mountain face above our "Crow's Nest" camp at 15,400 feet was in just as excellent shape as the hill we had fought all morning—two hundred feet below. From 4 o'clock till 7 Jim and I took turns chopping steps in the most wretched snow imaginable.

On the surface there was a thin, breakable crust; under it a layer of granular snow about like buckshot; then another thin crust, then a

few inches of powdery snow, and finally a solid mass of hard blue ice, all sloping much more than the average roof.

We wore crampons and were tied to opposite ends of a 120-foot nylon rope. The man who was not chopping steps constantly watched the rope in case of a slip. Neither of us spoke. We just chopped and chopped.

Below the top of the shoulder the going became so steep, and sandwiched layers of dirty snow and thin ice so treacherous, that we were often better off simply pulling our bodies up better going in steep rock ledges.

The wind was rising again, and, despite the fact that the ridge was now only a stone's throw ahead, we decided to retreat to camp and return to our task in the morning. It is not wise to climb on so steep a pitch when one is cold, exhausted, and hungry.

As we descended, we drove three 5-foot oak pegs into the snow and strung a length of sturdy hand line all the way down to camp.

It was late that night before Jim, Bill, and I finished building an igloo beneath an overhanging ice cliff at the Crow's Nest. Henry and John, after helping us carry up supplies, had returned to the Windy Corner camp. Knowing our time was limited, they generously agreed to let us go up first. They would follow us to the summit later.

A furious westerly gale roared over camp all night. When we awoke, the sun was high and the wind had died to a lull. Beautiful cirrus clouds topped the summits of McKinley, Foraker, and Hunter (page 240).

We breakfasted and rested until noon, then tackled the big slope with 40-pound loads. What a contrast to our first trip! Fresh drifted snow now filled our steps, but this was easy to brush away. We climbed upward slowly but steadily, pulling on the hand line at each step.

Looking 8,000 Feet Down

In a scant hour we reached the top of the fixed rope. This time we were fresh and rested. Another hour of chopping brought us to firm rock, up which we scrambled easily to the very crest of the great West Buttress. Peering over its other side, we looked almost straight down 8,000 feet to the upper basin of Peters Glacier.

The ridge ahead was a granite knife edge, studded with angular boulders. As we neared 17,000 feet, the grade lessened and the rock changed abruptly from granite to slate at the geologic contact between the peak's granite core and the inky-black cap rock.

The wind blew on our backs in gusts of 30 to 40 miles an hour. In the lulls we could hear the gale roaring through the jagged ledges of the North Peak, half a mile away.



244

Part 20,000 Feet and More Going Up, Climbers Ascend South Peak's Crest

The ascent of South Peak's crest was about 10,000 feet of snow. The 10,000 feet of snow and the 10,000 feet of rock were the same. The snow was not too deep, but it was very hard. The rock was very hard and the snow was very hard. The snow was very hard and the rock was very hard. The snow was very hard and the rock was very hard.

As we moved the great mass of the snow a hard new ice started to show to the west at Devil's Pass.

The weather was worse than the snow. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard.

Next morning, we climbed back up with several men. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard.

We had to push on to the top of the snow for the first time. After 15 minutes of pushing and pulling we found ourselves back on our feet. We were walking on a snow.

During the night, sleeping with the snow, I

rolled one of the rock trail markers into the snow. I rolled one of the rock trail markers into the snow. I rolled one of the rock trail markers into the snow. I rolled one of the rock trail markers into the snow. I rolled one of the rock trail markers into the snow.

South Peak's crest of the snow was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard. The snow was very hard and the weather was very hard.

July 10 dawned with a blizzard. When I stirred out of the sleeping bag at 8 a.m., it was 70° above zero with a brisk south breeze, yet the thermometer showed 25° below.

We ate breakfast in a hurry and our guide bags needed for a trail lunch. Today our loads would be heavy, and the trail was over a rocky, steep supply of our patients' food, cameras, and film.

Off for the Summit

As we hoped, the last 1,000-foot slope leading to Denali Pass was relatively easy, covered with hard snow, pushed like ice. A snow dome on the windward side of the peak was suddenly lessened, we began to see mountain peaks and a deep valley. The summit was just ahead of us.

This was the same of our first expedition, but was not done by our 1948 expedition. When I had climbed the other side of Mount McKinley. It was still mostly covered with the yellow snow of many years, which had been blown to us by the wind. Some of the old logs were still there, but years before.

We ran toward the cache but, panting and weary, had to stop at once. Finally we reached it, out of breath and speechless. We took hands heartily. At long last McKinley was ours. "We have done it!"

We opened a small bag of the snow, and the wind was so strong. As I was about to eat, I felt a cold wind. I saw a spot where we had put a large cache of food. The wind was so strong at the end of the 1948 expedition.

Recording Thermometer Shows 59

A sudden scene of confusion met our eyes. The party which had climbed McKinley in 1948, probably in desperate need of supplies, had ripped off the tents and parachutes with which we had covered the cache, and left it unprotected. Snow and ice, driven by a strong



Old Glory Signals the Victory over McKinley's Western Slopes

After a long and arduous climb, the two men, who had been climbing since the morning, reached the summit of McKinley's Western Slopes. The photograph shows the two men standing on the peak, with the American flag flying in the background. The terrain is rugged and covered in snow.

ing gales had penetrated every crack and crevice. The whole heap was now a solid rigid mass. Only about a third of the cache remained.

In a nearby place, we found the American flag, which had been flying for many days. It was now a solid mass of snow. The flag was still flying, but the poles were broken. It was a surprising sight, but it was a sign of the victory.

After a long and arduous climb, the two men, who had been climbing since the morning, reached the summit of McKinley's Western Slopes. The photograph shows the two men standing on the peak, with the American flag flying in the background. The terrain is rugged and covered in snow.

In 1948 we had found another redpoll and a Lutescent longspur near the pass. In the early morning, many thousands of birds were flying about the peak. It was a sight to be remembered.

far up on McKinley by warm spring gales.

Though our main objective had been attained, one goal still beckoned. All three of us had stood on the summit of McKinley before; yet we now had a compelling desire to climb to that snowy crest just once more.

To the Tiptop of a Continent

A plume-like cloud coursed over the tip of the peak, but we knew it would vanish in the chill of late afternoon. As we climbed, the cloud dropped lower, and at 19,000 feet we were inching forward through dense fog. But now that we knew the way, every undulation of the snow was like a familiar tree or signpost, for McKinley's upper dome changes scarcely at all from year to year.

At 5 p. m. the clouds melted away, and the summit of McKinley rose directly ahead, magnificent in a fresh coat of silver frost. We worked upward over the corniced drifts, fingers numb from taking pictures. Forty-five minutes later we topped the final drift of McKinley's South Peak, and the whole amazing panorama to the east burst upon us.

It was almost cloudless in every direction. Mount Hayes, sharp and clear, cut the horizon 140 miles to the east. To the southeast lay the Chugach Mountains and the misty gray haze which we knew must hide Cook Inlet and Anchorage. The huge white masses of the Kachilna and Mulikow Glaciers wound toward the lowlands through a staggering sea of jagged peaks.

Most impressive of all was the deep emerald green of the lowlands to south and west. River after river sparkled in the afternoon sun, twisting off into the distance. As Archdeacon Hudson Stuck said after his first ascent of McKinley 38 years before, it was like looking out the very windows of heaven.

As it grew later, the temperature dropped rapidly below zero, and the gusty wind cut our faces like a knife. Despite heavy clothing we began to feel the intense burning cold of great altitude.

Panorama of 100,000 Square Miles

Yet we hated to leave. Each of us knew he might never see this marvelous sight again, a cloudless panorama stretching nearly 400 miles from horizon to horizon, 100,000 square miles of Alaska visible in a single sweeping glance.

At 6.15 we tied a bit of orange hunting to the tip of the 8-foot bamboo survey marker that still remained on the summit from our 1947 trip (pages 246 and 247). Then we headed downward to our last igloo, shivering uncontrollably from the bitter cold.

Descending next day, even with heavy packs, was almost pathetically easy compared

with the rigors of the long and grueling ascent.

On the trail we passed the other members of our party in two groups, upward bound in high spirits. On July 13 and 14 they had reached the summit. We were back at camp that night in Kachilna Pass, making the entire retreat from our highest camp in a single day.

But our thrills were not quite all behind us. We radioed to Terry Moore that the vanguard of the party was ready to be flown out, and he replied, "Will come this evening."

The sun had dropped behind Kachilna Pass when we heard a faint hum. It grew louder, echoing from the cliffs. Two minutes later, Terry was taxiing safely toward the tents.

"Gee, that was a tough one! No more landings tonight!" were his first words as he climbed out. "The camp looked as if it were floating in a bottomless sea of gray milk. I'll take only one man out tonight."

It was agreed that I would go on the first trip. It was a thrilling take-off. High clouds aflame with sunset covered the sky. Every peak about us was pink with alpine glow.

Back to the Soft, Fresh Lowlands

I caught a final glimpse of Jim's and Bill's worried faces as we started moving. We passed the end of the runway and headed down the steep, smooth snow slope of the glacier. Suddenly I realized we were in the air. Terry's eyes twinkled triumphantly. "We made it, pard!" he shouted.

The sun was slipping behind the vast Yukon lowlands to the northwest as we flew over Wonder Lake and glided into the little Kantishna airfield. I'll never forget the lush green of that valley, the beauty of the spruces, and the smell of grass and flowers that came in the plane windows even before we touched the ground. The whole world down there seemed soft, fresh, and delicious after the cold, icy resolution of the heights.

At daybreak on July 15 Bill and Jim were flown safely out, and 10 days later the others followed.

McKinley had been climbed from the west, safely and speedily, in only seven days from Kachilna Pass. We had proved that airplanes, loaded or unloaded, could land and take off halfway up that side of the peak. Mel Griffiths had completed his geologic work. My survey was done and checked. Not even a minor accident had occurred.

Our new route up McKinley's "impenetrable" western face had turned out to be even shorter than I had hoped it might be when I had first seen it on our National Geographic photographic flights 15 years before. It was proved to be an ideal avenue of approach for future scientific work atop the roof of North America.

Wildlife of Mount McKinley National Park 225

Predators and Their Prey Live Unmolested in Mount Alaska's Arctic Refuge
3,000 Square Miles of Spectacular Wilderness

By ADOLPH MURIE

Biologist, National Park Service

North Platte, Neb., by Walter A. Weber, National Geographic Magazine Staff Artist

IN the creek ahead we saw a dark object that reached almost from shore to shore. We stopped for a better look. A grizzly bear lying in the creek was enjoying the cool play of the current on its skin. A cub frolicked at the big animal's side.

"It's probably Nokomis," I said as we scrambled from the rattletrap truck. "She's the only grizzly in the area with one cub."

Walter A. Weber, NATIONAL GEOGRAPHIC naturalist and artist, had come to Mount McKinley National Park to paint and study Alaskan wildlife (map, page 222). He especially wanted to see grizzlies. Here, on our second day in the field, we had found one, and ~~there would be no more~~. Bears bathe quite often, but men rarely see them doing it. We set up our cameras to record the scene.

Suddenly the old bear, 80 yards away, stood up and eyed us. I thought she was standing up to stretch.

Our confidence vanished when the grizzly nervously "chomped" her jaws together several times. We could see her yellowed teeth. Probably she was trying to scent us.

A bedlam of squalls and backs erupted behind us. Another grizzly cub was pacing back and forth on the hillside directly ~~behind us~~. Unnoticed, it had been playing there when we arrived.

Between a Grizzly and Her Cubs

My mistake was evident. This was not Nokomis at all. Our bathing bear must be Old Rosy, mother of ~~two~~ cubs. Now we found ourselves between an irate grizzly and her frightened cub—a classic example of the wrong place to be.

"I don't like the looks of this," Walter said, as the bear dropped onto four feet.

We grabbed our cameras and sprinted down the road. Branches snapped and crackled behind us as Old Rosy plowed through the brush toward her second cub. We jumped into the truck and drove away.

Seconds later the grizzly broke out onto the highway. She gave us a side-long glance and continued uphill, trailed by cub number one. Stopping at a safe distance, we watched the little leader's retreat.

Walter later watched Old Rosy through binoculars and made the sketches he wanted. The painting (page 263) shows her in a less belligerent mood as she shepherds her two cubs across a sweeping plateau.

Color Films Supplement Sketches

To ensure accuracy, artist-naturalist Weber supplements his own memory and notes with sketches and motion pictures he makes on the spot. Later, at The Society's headquarters in Washington, D. C., he projects the color films above his easel, stopping their motion with a push-button arrangement to study a creature in characteristic pose (page 270).

Kodachrome slides of typical park plants and landscapes aid him in painting backgrounds. Specimens from his own collection or from museums round out his original source material.

Walter Weber and I are old friends and it was my pleasant duty to act as guide during his stay in Mount McKinley National Park. For a month we roamed an unspoiled wilderness, enjoying the same majestic scenery and far-north environment that trail-blazing Charles Sheldon, the hunter-naturalist, explored in 1906 and again in 1907-08. It was largely because of Sheldon's observations and accounts that part of the Alaska Range was set aside in 1917 as a national park.

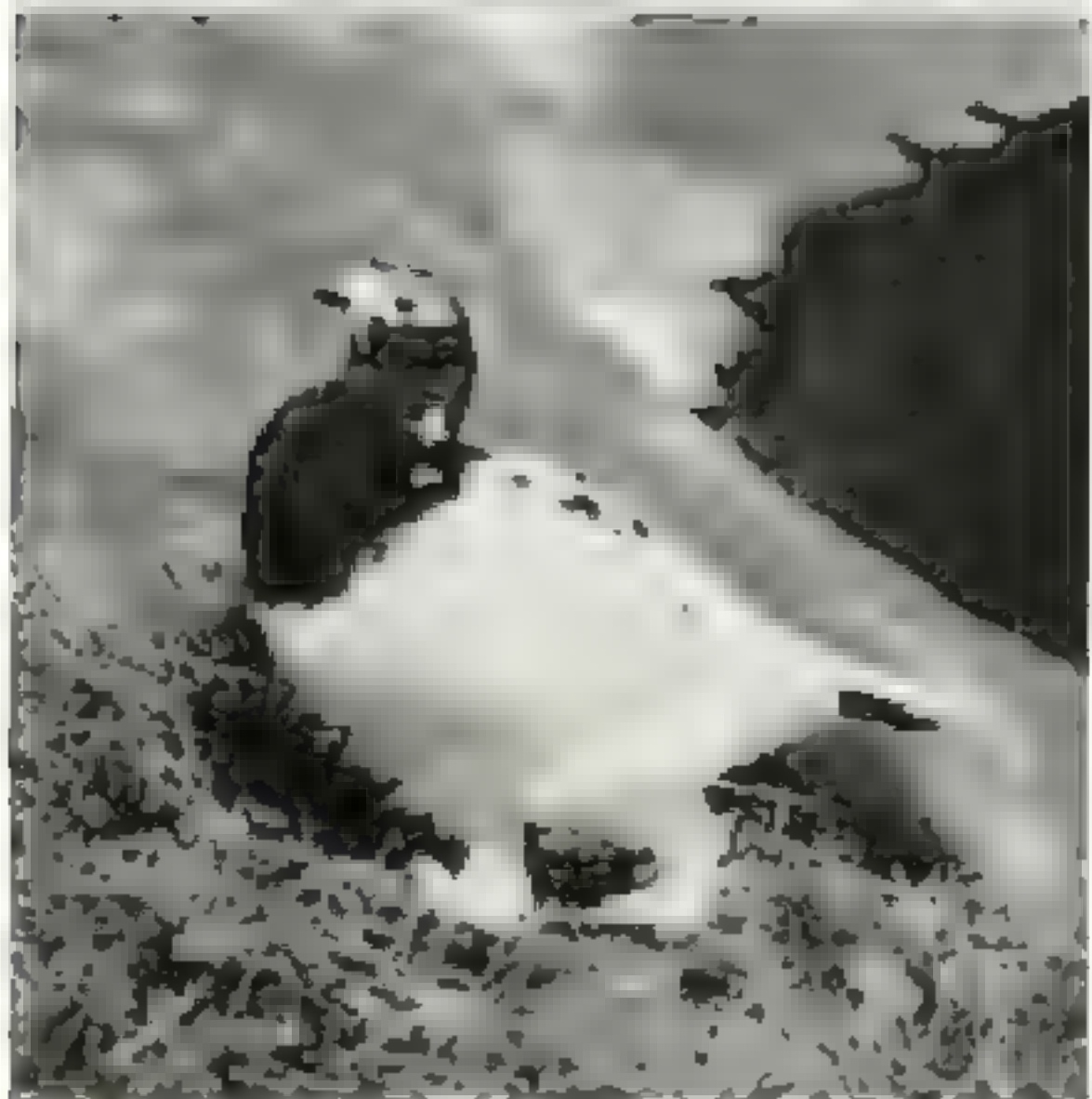
Today the park covers 3,000 square miles and is the Nation's second largest national park; 120 species of birds and 36 species of mammals have been identified within its boundaries.

Crowning glory is lofty Mount McKinley, highest peak in North America. The erudite monarch reaches an altitude of more than 20,000 feet above sea level. It alone surpasses the park's wildlife as an attraction for the growing influx of visitors.

An excellent highway runs through the refuge, providing ready access to wildlife areas. The ~~area is so large that a horse and rider~~ often can be seen from the road.

After a few days in the eastern section we drove 88 miles westward to Wonder Lake, near the base of Mount McKinley, and set up headquarters in a lonely 5-room bungalow.

The little frame dwelling had an unhappy



Admission Free 756

For Every Civilization's Threats, Mount McKinley National Park Presents an Outdoor Museum

Against all odds, the great, rugged, and unyielding Mount McKinley National Park has become a museum of the past. In the park, the great, rugged, and unyielding Mount McKinley National Park has become a museum of the past. In the park, the great, rugged, and unyielding Mount McKinley National Park has become a museum of the past. In the park, the great, rugged, and unyielding Mount McKinley National Park has become a museum of the past.

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department. Even for park personnel, it had been never subjected to a series of house-wireing tests as I have grizzly.

Rapidly taken note, but huge paw marks, printed in muddy, the caribou's foot formed patterns on the floor, and perhaps some prints shown in window glass.

Incidentally, the caribou is not a native of the region, but a recent arrival.

Caribou, Nomads of the Arctic

I have been fortunate in seeing and to stalk these handsome relatives of the domesticated reindeer, the caribou.

No product of an artist's license, page 253 shows caribou as Walter actually saw them in the forest of the forest of the top of Mount McKinley.

Caribou are restless, migratory animals. The pattern of their wandering is uncertain.

It may be the same for a period of years, then it may change drastically.

Anska has several caribou herds. One herd spends part of each year in the park, leaving the area in the winter and moving westward usually in the spring, and back to the park in the fall. After traveling some high place on the south side of the Alaska Range, they cross in late July, when they enter the stream westward again.

I have counted as many as 100 in a single herd, but part of the herd is lost.

We found many small, scattered groups of caribou. Once we stalked two fine bulls with sweeping angular antlers. Both were adults, but only one had attained the glistening white coat, the brilliant white hair, and the whiteness spreading over the shoulders and along the flanks that are characteristic of the fully developed adult.

Circling downwind, we approached the animals as they grazed among scattered spruce trees. Slowly we set up our cameras. The caribou's eyesight is anything but keen; only sudden movement would betray us.

The bulls looked our way a few times as if suspicious. After a while they lay down contentedly. Then, for no apparent reason, both jumped to their feet and dashed off.

Fly Tormentors Smell a Picture

Our comments were sulphurous. Probably the animals had been set upon by nose bottles or warble flies. The latter deposit eggs on the legs and flanks of the caribou. After hatching, the larvae penetrate the leg and by the following spring have burrowed through to the back, where they emerge as fat grubs. The grubs drop to the ground, where they change into tormenting flies.

It was now late August. Hill and tundra blazed with brilliant shades of crimson, yellow, and gold. Against this vivid background the lordly male caribou seemed the epitome of wilderness splendor.

Some years later I saw antlers stuck up for serious fights later in autumn when each adult male would attempt to round up and defend against all rivals a dozen or more cows.

Caribou are the chief source of food for the big timber wolf.* Unfortunately, we failed to sight one of these powerful predators, but I did point out a river bluff burrow where I had observed wolves often. Lounging by the den, I told Walter the story of its tenants.

I had discovered the wolves' hideaway one May morning while following telltale pad marks in light snow. Two adults ran from the entrance when I approached. Crawling inside, I found six dumpy, blunt-nosed puppies, their eyes still closed. I wrapped one of them in my parka and carried it home.

The little captive, a female, grew rapidly on canned milk. She became a friendly pet, beloved by my wife and 5-year-old daughter Gail. Because of the wolf's good-natured tail waving, Gail named her Wags.

Wolves Call on the Family Pet

Wags was kept on a chain outside our cabin where she received visits day and night from neighborhood wolves. Their boldness made us fearful for Gail's safety, but despite misgivings we kept our pet for a year. Finally we gave her to the rangers at park headquarters.

From a near-by treetop I watched the wolf family from which I had abducted Wags and made daily notes on their habits.

It had always been thought that a den of wolves consisted only of parents and young.

* See "Canada Counts Its Caribou," *National Geographic Magazine*, August, 1932.

To my surprise, I discovered that in addition to Wags's mother and father there were two other adult males and a female living at the den. Three years of observation indicated that these additional wolves were not young of the previous year, as might be assumed.

All the adults were friendly with one another and amiable toward the pups. Before leaving for a night hunt the wolves often engaged in ceremonious tail wagging and shoulder rubbing; occasionally they enjoyed a playful romp. Several times the unattached female sat with the puppies while their mother joined the night hunt.

Undoubtedly the animals had some quarrels, but I observed a side of their nature that has not entered into wolf tradition.

On one occasion, secure in my ridgetop hideaway, I watched the five wolves stage a memorable battle royal with a big male grizzly. The bear got a strong whiff of caribou meat, cached by the wolves in a thicket, and headed straight for the site.

Grizzly Meets His Masters

Too late he realized his mistake. The pack, which had been resting under cover, dashed out to attack. The grizzly turned and ran, but he was soon overtaken and encircled. The wolves slashed at his flanks. As he turned on one tormentor, another rushed in. The nimble attackers easily avoided his lunges.

The battle lasted 10 minutes, but its outcome was never in doubt. The overmatched bear retreated slowly. Eventually the wolves permitted him to lumber off.

Walter took notes as I described the episode. Later he reconstructed it in a wonderfully realistic painting (page 259).

The lynx is a perfect example of an animal whose fate closely depends on a prey species (page 262). When the snowshoe rabbit is abundant, the lynx prospers. Periodically, however, the rabbits die in large numbers. Deprived of their main food source, the big cats become enfeebled and dwindle in number until rabbits again become plentiful.

Foxes, too, are sometimes affected by population cycles, though to a less degree than the lynx. McKinley Park's red foxes maintain themselves in good numbers (page 255). When their staple food such as squirrels, rabbits, mice, and ptarmigan is scarce, many foxes survive by feeding more extensively on crowberries and blueberries.

Ornithologists visiting the park invariably inquire about two of its most elusive residents, the wandering tattler and the surf-bird (pages 264 and 265).

In 1921 a downy young surf-bird was discovered in the Fortymile River country, in
(Text continued on page 269)



WALTER A. WEBER.

Caribou Scenn the Wind for Danger as They Cross a Ridge Beneath Mount McKinley

Art. Walter A. Weber camped 10 p.m. on the ridge beneath Mount McKinley, National Park. A mature Stone's Caribou bull leads a young male (center) and a female (right) across the ridge.



A Golden Eagle Shows Daggerlike Talons into a Favored Prey, the Hoary Marmot
 and squirrels are another prey of the Golden Eagle's. The Hoary Marmot, at the summit of its winter
 burrow, is above the eagle. The marmot is at the entrance of its burrow.



Father's Return from the Hunt Brings Mother Fox and Hungry Pups from Their Den.
 Foxes were early tame to the park sanctuary. Some will even take food from visitors' hands. The male carrying a Ground Squirrel, is an Alaskan Red Fox, like his mate. His black coat is a color phase.



WALTER A. WHEELER

National Geographic Society

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W. H. W. Ptarmigan in Late Summer Plumage. View from a Thicket of Pine and Crowberry. Left. Feathered Ties Serve as Snowshoes.

A White Snow Grouse, Charming in Plumage with Puffed Throat, Head, and Neck





WILLIAM A. W. J.





Racing for Safety, a Tocklat Valley Hawk Owl, its Arch Enemy, the Hawk Owl, by Archer
 Day. The Hawk Owl, of the Tocklat Valley, is a rare bird, and is found only in the
 Tocklat Valley. A hawk owl, of the Tocklat Valley, is a rare bird, and is found only in the
 Tocklat Valley.



A Gyrfalcon Clutches the Body of a Rock Ptarmigan Struck in Mid-air

Gyrfalcons are the largest birds of prey in the world. They are found in the Arctic regions of North America and Europe. The Rock Ptarmigan is a common game bird in the Arctic regions of North America.



W. J. WEBER

— Snowshoe Hares —





WALTER A. GORDON

Wandering Tattlers, Disturbed near Their Nest, Chirp a Loud and Excited Protest

Tattlers. — Known to all as gravel eaters, but only two of all this practically colored race have ever been known to feed on gravel. In Mount McKinley National Park. A Golden Plover stands on the farther shore from the lake in the Arctic North Sea.



A Plump Sarcid Ignored the Courtship Antics of Small Neighbors, the Wheatears

With spread wings and fluttering flight, male Wheatears vie for the favor of Sarcids in the rocky crevices of the coast. The small, yellow-bellied wheatears, with their distinctive yellow and blue plumage, are seen in the foreground, while the larger, more robust Sarcids are seen in the background, perched on the rocks.



WALTER A. WEBER

PLATE 100

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A Fearless Little Pigeon Hawk (Right) Breaks Up an Aerial Duet. Ravens and Goshawks, Forcing a General Retreat



WALTER A. BECKER



A. WEBER

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Wild Sheep Range, Colorado

Rocky Over Search for Danger as Bad Sheep Range Cross a Rocky Hillside
 The wild sheep are seen in the foreground, and the mountains in the background.

another part of Alaska. But it was not until May 25, 1926, that the first and only surfbird nest known to science was found within the McKinley Park area by George M. Wright. He and Joseph S. Dixon were walking across a rocky ridge when a nesting surfbird exploded into the air from beneath Wright's feet.

This sudden bursting-into-flight serves to startle mountain sheep and thus keeps the nests from being trampled.

We know now that the surfbird raises its family in the high country above timberline in Alaska's interior. It winters along rocky Pacific coast beaches as far south as Chile.

First Wandering Tattler Nests

On July 1, 1923, my brother Olaus and I were driving a team of horses on a gravel bar of Alaska's Savage River. Suddenly a wandering tattler burst into the air just ahead of us. Near a wheel rut we found its nest.

In 1939 I discovered a second nest. They are still the only ones recorded, although the bird itself is common enough in the Arctic Range. It winters along the Pacific coast of the United States, in the Hawaiian Islands, and in faraway New Zealand.

To me the powerful golden eagle, with its wingspread of more than seven feet, is one of Nature's most splendid creations (page 254). Some years ago the park eagles were suspected of preying widely upon the lambs of mountain sheep, so I turned detective.

Visiting many cliffside nests, I gathered pellets of undigested bones, feathers, and fur, which the eagle regurgitates after a meal. Examination of the pellets revealed that more than 90 percent of the bird's diet consists of ground squirrels and hoary marmots. A few lambs are undoubtedly taken, but the effect on the sheep population is insignificant, I was happy to report.

The bird that perhaps best typifies the North is the willow ptarmigan, an arctic representative of the grouse family (pages 250, 256).

We met many of these birds prospecting for gravel along the road. They proved so tame and confident, clucking softly or crying *come-ere, come-ere, come-ere*, that frequently we were able to herd them toward our cameras.

Ptarmigan Dress for the Season

Also present in the park are two other ptarmigan species, the rock (page 261) and the white-tailed. The rock ptarmigan's call is low and guttural somewhat like the croak of a bullfrog. The white-tailed, tinnest of the three, utters a high-pitched scream, not at all in keeping with its personality.

All three species change dress with the seasons, matching winter's snow with white out-

fits, donning brown-and-gray plumage in spring when the snow melts. In late summer and fall they display snowy underparts and brownish feathering above, as in the color plate on page 256.

While camping in a spruce woods we studied the activities of a winsome little field mouse, the Toklat vole, named for Alaska's Toklat River.

Like the squirrel, which stores nuts for the future, the Toklat vole is a provident creature. Each summer it harvests hay to feed upon during winter. Great care is taken to keep the hay dry.

Near our cabin we found many miniature haystacks, usually piled between the basal branches of dwarf trees or bushes and on exposed roots of spruces.

Some of the vole's burrows have an ingenious construction, a series of small chambers connected by narrow passages, so that a burrow resembles a pearl necklace. Connecting passages are so narrow that the vole can just squeeze through. A pursuing enemy, such as the weasel, would have to stop and enlarge each passage.

Scanning the spruce tops, we discovered several hawk owls, beautiful northern birds that do much hunting in daylight. The painting of the owl swooping on the Toklat vole reproduces a scene I witnessed (page 260).

From a hilltop we saw also a pigeon hawk break up an aerial dogfight between a goshawk and some ravens (page 266). The strappy little pigeon hawk, highly maneuverable, chased his larger opponent all over the sky and finally drove him from the area.

We Stalk a Herd of Rams

Soon mid-September was upon us, and there was time for only one more camera hunt. We set out for the high, craggy ridges in search of Dall sheep (opposite and page 250).

These mountain sheep are among the hardiest animals of the Mount McKinley region. In summer they appear to be pure white. Against the snow a slight yellowish tinge is apparent. The rams have graceful, curving horns, decoratively wrinkled. A good-sized male will stand about 39 inches at the shoulders and weigh approximately 200 pounds.

For 60 miles the park highway passes through sheep range. In spring, lambs may be seen frisking along the cliffs and ledges, developing their legs, already strong a day or two after birth.

Rattling along the highway in our truck, we sighted 20 rams in the cliffs high above us. A dry river bed promised an approach. After we began a slow, laborious climb.

The park sheep, though they possess excep-



Artist Weber Checks Printer's Proofs of His Pictures for Color Accuracy

The National Geographic Society's artist, Walter Weber, is shown here checking the printer's proofs of his pictures for color accuracy. A lot of the work of the artist is to make his pictures as accurate as possible. There is a great deal of work in this line, and the artist must be very careful in his work. Walter Weber is a professional artist, and at the present time is working on the proofs of his pictures.

usually have a faint character, he studied in the past. He found it was a long and tedious job, and a great disappointment for a young man who had been like to be a painter. He had been working on the proofs of his pictures, and at the present time is working on the proofs of his pictures.

As we reached our destination, the sun was in the sky. The hunt began to grow dim, and the sun was bathed in a red glow. The sun was in the sky.

In addition to our woes, a stray ram jumped from behind a rock and startled the herd. The animals vanished over a rise to reappear on a distant crag.

"What Happened to the Light?"

We stopped for a moment to rest. Walter growled, "We finally get here. There's no luck and no light. I never saw such a queer day. The sun is out, but what happened to the light?"

Retiring disconsolately to camp, we soon learned the answer. For our sleep hunt was scheduled for the day the one on which a "partial eclipse" of the sun occurs.

But luck, and the sun, favored us a few days later. We maneuvered to within 40 yards of another band of animals and spent several hours photographing them.

It was Walter's last day in the park. As we clambered down the steep cliffs, I noticed how the great mountain in the distance was reflected in the dark, jagged crags, and the alpine scenery toward distant Mount McKinley.

The next day, starting the same journey, I knew what we were doing.

There is a "park" in the world, a true wilderness, a splendid refuge where God's lesser creatures can follow their natural destinies in a special area of human good will.

May it never change.

Tracing Lost Indian Civilizations, an Archaeologist and His Wife
Narrowly Escape Disaster on the Isthmus' Wild North Coast

By MATTHEW W. STIRLING

With Illustrations by National Geographic, Photographs by Richard H. Stoddard

WESTWARD for 130 miles from the busy world crossroads of the Panama Canal extends one of the most isolated and inaccessible coastal stretches of the Western Hemisphere.

This almost-forgotten region, where primitive ways of life still survive, is the jungle-matted north shore of Panama which faces the Caribbean Sea between the Canal Zone and the Laguna de Chiriquí (map, page 275).

All year winds sweep the coast, ridging the sea with huge rollers that beat against the shore in a booming surf. There are no harbors and few anchorages, even for small craft. The rough mountains of the isthmus, cloaked with tropical forest and drenched by soaking rains most of the year, extend down to the sea.

This wild land is sparsely peopled in the interior by Indians in direct bloodline from the aborigines of pre-Columbian times, and along the seacoast mostly by Negroes, many of whose ancestors probably were escaped slaves. These inhabitants have virtually no contact with the outside world.

A few small launches periodically visit the coast to pick up cargoes of bananas; ill-marked and difficult jungle trails twist across the mountains.

Yet it was in this area that Columbus, on his fourth voyage to the New World in 1512-13 first found in any quantity the gold he sought. Here he established the first Spanish colony on America's mainland, at the mouth of the Rio Belén. Along this coast, too, he encountered the greatest difficulties with storm and surf of his entire career.

In the Footsteps of Columbus

On a gray January dawn my wife Marlin and I arrived off this inhospitable shore at the mouth of the Rio Coclé del Norte on one of the semi-monthly banana boats.

We had come, under the joint auspices of the National Geographic Society and the Smithsonian Institution, not to seek gold but to hunt for pottery, arrowheads, stone axes, violent graves, and other remains of the Indians who lived here during and before the time of Columbus. We hoped to gain from a study of such relics a better understanding of the rise of prehistoric Indian civilizations in the New World.

All night long on the voyage from Colón, in the Canal Zone, our little craft had pitched and tossed in heavy swells, fully living up to her name, *Tumbaita*, the Little Tossy. As we rose stiffly from fitful sleep on the hard deck, we could see white breakers underlining the base of lonely green-clad mountains.

Explorers Have Shunned the Area

Ever since the time of Columbus explorers have shunned this forbidding land. For centuries it has defeated those who sought the gold reported in Columbus's accounts.

We were to face far greater difficulties and dangers here than on any of our previous expeditions to study the archeology and prehistory of Middle America*.

Our first visit to the Coclé del Norte was a scouting trip for later explorations, for we had been unable elsewhere to find reliable information about the interior. Almost nothing has been published about this area since the accounts of Columbus's voyage 450 years ago.

As the wind whipped the waves and *Tumbaita* labored in the heavy sea a mile offshore, we were reminded of a passage written by the great explorer of this very coast:

"... The storm recommenced, and wearied me to such a degree that I absolutely knew not what to do... never was the sea so high, so terrific, and so covered with foam; not only did the wind oppose our proceeding onward, but it also rendered it highly dangerous to run in for any headland, and kept me in that sea which seemed to me as a sea of blood seething like a caldron on a mighty fire... All this time the waters from heaven never ceased descending, not to say that it rained, for it was like a repetition of the deluge..."†

Though we did not realize it then, these words were strangely prophetic of what was to happen to us.

Accounts of Columbus's voyage tell that the Spaniards found the Indians wearing gold ornaments in the shape of disks, frogs, and

* For fully of previous article, on excavations in Panama and Mexico by Dr. Stirling, who is Director of the Bureau of American Ethnology, Smithsonian Institution, see the two-volume Cumulative Index to the NATIONAL GEOGRAPHIC MAGAZINE, 1896-1957.

† From *Selected Letters of Christopher Columbus*, translated by R. H. Major, published by the Hakluyt Society, London, 1897—page 179.



Solemn Brown Faces Reflect the Wonder of Music from the Air

None of the Indians had heard a radio before; the little boy seemed awestruck. He ran with the tape and the receiver, screaming in delight that he had found a new treasure. The rest of the group, the women and children, gathered around him, looking on with interest and awe.

They crowded around him, looking at the tape and the receiver with interest and awe.

The white woman gained the upper hand at the first sight of the radio, and she was soon explaining to the Indians the wonders of the new machine. The older women, with their hands on their hips, looked at the radio with interest and awe. They were called to attention by the white woman, who was now holding the radio in her hands. They were called to attention by the white woman, who was now holding the radio in her hands.

The white woman was now holding the radio in her hands. She was explaining to the Indians the wonders of the new machine. The older women, with their hands on their hips, looked at the radio with interest and awe. They were called to attention by the white woman, who was now holding the radio in her hands.

of the new machine. The older women, with their hands on their hips, looked at the radio with interest and awe. They were called to attention by the white woman, who was now holding the radio in her hands.

God is good. I am now holding the radio in my hands. I am now holding the radio in my hands. I am now holding the radio in my hands. I am now holding the radio in my hands. I am now holding the radio in my hands. I am now holding the radio in my hands.

Legends of Lost Mines Persist

The large majority of the population of the region are still in the habit of believing in the existence of lost mines. The legends of lost mines are still in the habit of believing in the existence of lost mines. The legends of lost mines are still in the habit of believing in the existence of lost mines.



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An Outboard-Engine Dingy Ploes the Swollen Rio Indio

After a stormy night on the river, the boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

Small! Soon all the passengers were comfortably seated. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

From there we drove back to our headquarters near Saluda. Six miles west of the Canal Zone, where we had begun our journey, the river flows through a series of small, fertile valleys.

Here we joined the staff of the NATIONAL GEOGRAPHIC

Museum and the staff of the National Geographic Society. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

We then drove to Panama to study the aboriginal and prehistoric Indian cultures which the two great continents of America have created. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

Cultures Produce Christian Era

In each of these areas, several centuries before the Christian Era, high cultures were produced. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

They have made peculiar pottery, as with stirrup-shaped supports, the water flowing out through two channels that converge at a point. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

They have made peculiar pottery, as with stirrup-shaped supports, the water flowing out through two channels that converge at a point. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

used similar forms of large canals.

Recent archaeological discoveries indicate that the cradle of American Indian civilization was in northwestern South America, not in the Valley of Mexico as formerly supposed. The boatmen, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

The boats and their passengers, guided by a local pilot, made a dash for the open water. The boatmen, guided by a local pilot, made a dash for the open water.

Maya of Central America were skilled in architecture, mathematics, and stone sculpture. Ideas were constantly borrowed and exchanged. Obviously these exchanges must have passed through the Isthmus of Panama; it was logical to search here for evidences of them.

In two previous trips we had studied the archeology of Panama's Pacific coast, and now, during this third season in 1951, we hoped to explore the little-known north coast and complete an archeological cross section of the isthmus. As in previous years, our old friend Dr. Alejandro Mendez, director of the Panama National Museum, assisted us.

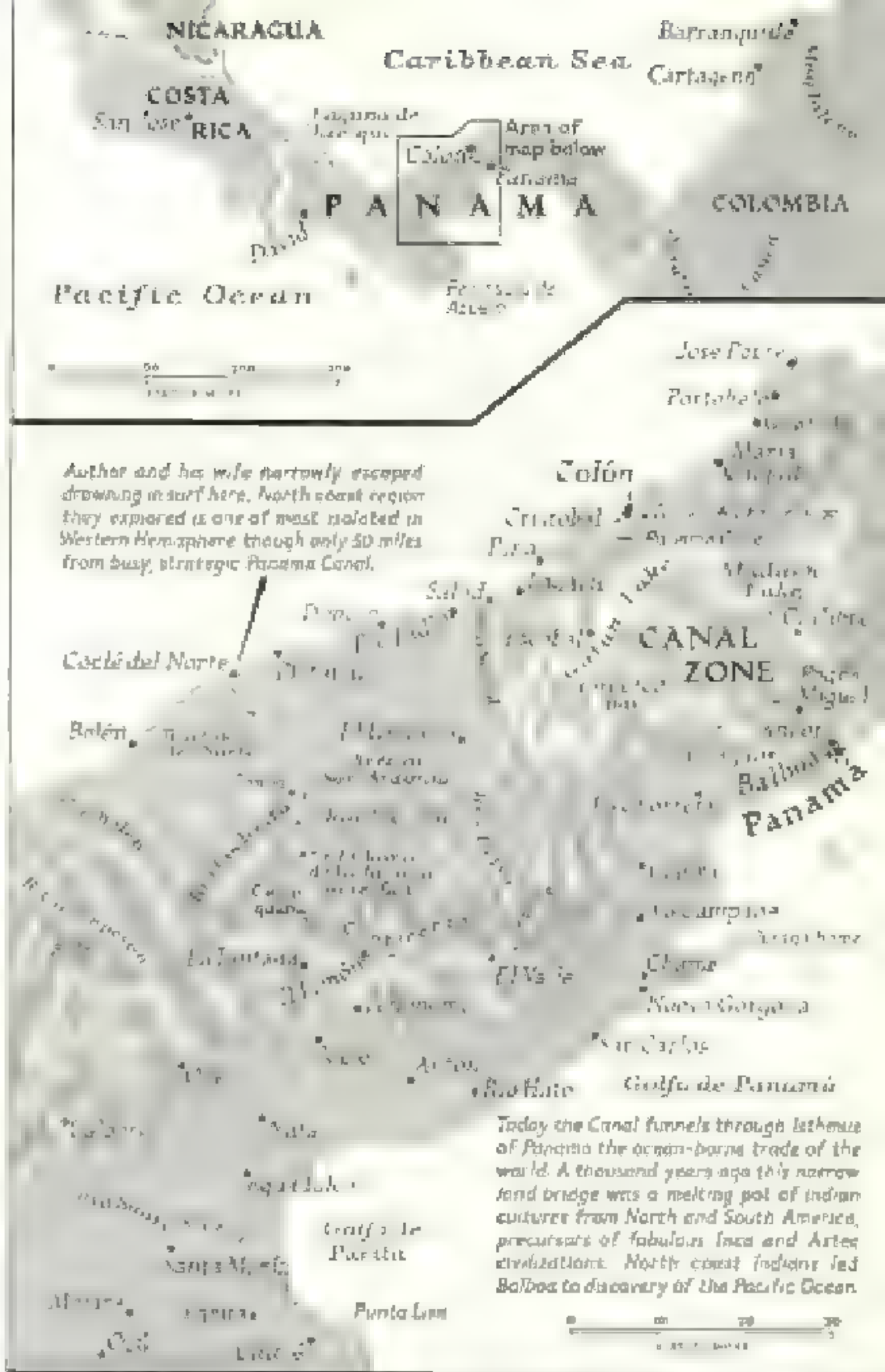
Back of Beyond

Now we were ready to set forth into the isolated country along the Rio Indio and the Rio Cocolé del Norte. No vestige of a road extends westward beyond the Rio Salud.

We decided to tackle the Indio first. Since its mouth was only a two hours' walk along the beach beside the surf, we organized what we jokingly called a "surfati" of 18 carriers, who transported our boxes and bundles.

Dr. Shirley Gage, a vacationing woman physician from New York State, joined us for a trip up the Indio. She had done several years of medical work in China and wished to study a region which modern medicine had not reached.

Approaching the town of Rio Indio (pages 277, 287), we saw that most of the men there, all Negroes, were dressed for a fiesta. They wore full ceremonial hats decorated with flowers and bright-colored feathers. They had painted their faces red, white, or blue, and talked backwards or in a strange glibberish that said the opposite of what they meant. The celebration is known as the "Congo" or "Congo," perhaps in reference to their African ancestry.



Scientists Probe Panama Wilds Shunned Since Columbus

The discoverer found wild land from the Caribbean in 1503. At the mouth of the Rio Chiriquí he set up the New World's first mainland Spanish colony. Up the neighboring rivers Cocolé del Norte, today, and Salud, today, the land is still largely unexplored and contains Indian cultures at modern and long-buried village sites.

No sooner had we arrived than it seemed this unfriendly land was taking revenge upon us for daring to probe its long-hidden secrets. That time of year, January to April, was supposed to be the dry season; yet it rained in torrents almost constantly. The rain was so frequent that often we were not dry for two or three days and nights in a row.

We slugged over muddy trails and made short excursions by canoe to archeological

sites, questioning the natives as to possible new locations. An old man, who several years ago had found a gold frog and a gold "pencil" (probably a rod worn as an earring) while tilling his field, led us to the place, high on a ridge.

Fragments of broken pottery were strewn about, where they had lain undisturbed since before the days of Columbus. We unearthed a massive door 19 by 10 feet, made of 15 slabs of a hard green sandstone carefully fitted as a mosaic, each about 10 inches thick and 5 feet wide. Probably it was all that remained of an aboriginal temple. Around the door we uncovered quantities of pottery, stone axes, and fragments of stones for grinding corn. As in all the sites we had found, the pottery was unpainted and undecorated.

Piled Potsherds Locate Doors

Potsherds were a sure clue to ancient house sites. Locations were easy to spot, being the only level places in otherwise hilly terrain. We could even place the door of a house; it was where the pile of discarded broken pots was largest.

Excavating archeological specimens calls for painstaking care, both to prevent breakage and to record their exact location. Scale diagrams are made of each trench. On these each specimen is entered, showing at a glance its relation to other objects found above and below it.

Collecting thousands of fragments of broken potsherds may not sound exciting, but the archeologist depends largely on pottery types to distinguish various cultures and to establish their chronological order. In the same way one might trace the development of life in various countries by successive types of lighting fixtures used; first, pine knot torches, then candlesticks, oil lamps, gaslights, and finally electric bulbs. Pottery, because it is more or less imperishable, survives where many other artifacts disappear.

Apart from helping to solve prehistoric problems, much Panamanian pottery, particularly that of the Indian period, is beautifully designed and decorated. It makes easier an appreciation of the Indian civilization that so impressed the Spaniards of the early 16th century. Many of the bowls with tall pedestal bases would make decorative additions to any room even today. They are embellished with strange conventionalized designs representing birds, insects, animals, and reptiles.

We next set out for the rough country of the upper Rio Indio in a large canoe pushed by our own outboard motor (pages 274, 277). About a mile above the mouth the stream narrowed; here and there the tops of giant trees touched overhead. Many fallen trunks lay in the stream, and our guide worried lest

our propeller foul on barely submerged logs.

Rounding a bend, we came upon two Indians fishing from a canoe with bows and arrows, the latter fitted with three branching points. Bow-and-arrow fishing requires skill, for refraction of light by the water distorts the position of the fish, and the arrows penetrate only about a foot below the surface.

The fishermen agreed to pilot us through the maze of logs. We took their canoe in tow, while one of them stood in the bow of our craft and indicated the course by arm signals. For six hours we wove in and out among the logs, the river becoming more and more shallow. Finally our guides told us we could go no farther by water.

It was raining hard. We pitched camp in the mud atop a steep, slippery clay bank about 40 feet above the river. It was still raining in the morning when the owner of a neat by house came to inquire whether he might bring his family to our camp.

"They have never seen people like you," he told us (page 272).

He volunteered to guide us to a "house of sandstone" back in the jungle. Striking over all-marked trails, we came to a fantastically eroded ravine. It ended in a natural cave cutting through a sandstone formation for about 50 yards, like a large tunnel. A cluster of bats hung from the roof. This was the "casa de laja" which, according to tales we had heard on the coast, was the towered ruin of a masonry castle!

Our guide led us to a neat by place where his uncle had found a gold alligator. Everywhere potsherds were scattered, evidence of a large population in the days before Columbus. We excavated until the rain became a deluge.

River Rises 8 Feet Overnight

All the second night the downpour continued. Nothing revealed a river risen eight feet, an angry torrent of yellow water.

Since the water was now more than deep enough for the outboard motor, we moved upstream to the village of El Urcillo, on the first large fork of the Indio. Here ancient Indians had terraced slopes to support their village. The modern inhabitants, taking advantage of these ready-made house sites, cleared the area and built today's village, the only one in this part of the interior.

A new schoolhouse was under construction, with a cement floor and corrugated-iron roof. We received permission to occupy it. While the rain thundered down on the roof, we spread our blankets and clothing to dry.

We soon discovered that the entire village clearing was one large archeological site. Here we unearthed pottery painted in red, black,

(Text continued on page 285)



From the Unknown: the Expedition Starts Up Panama's Río Indio

The expedition started Río Indio along the river, and the men went on a long journey up the country, with the men and the boats of the river. A small boat was used to go up the river, and the men went on a long journey up the country, with the men and the boats of the river.

Conquerors on the Río Cache del Norte Waded as Often as They Rowed

The men went on a long journey up the river, and the men went on a long journey up the country, with the men and the boats of the river. A small boat was used to go up the river, and the men went on a long journey up the country, with the men and the boats of the river.





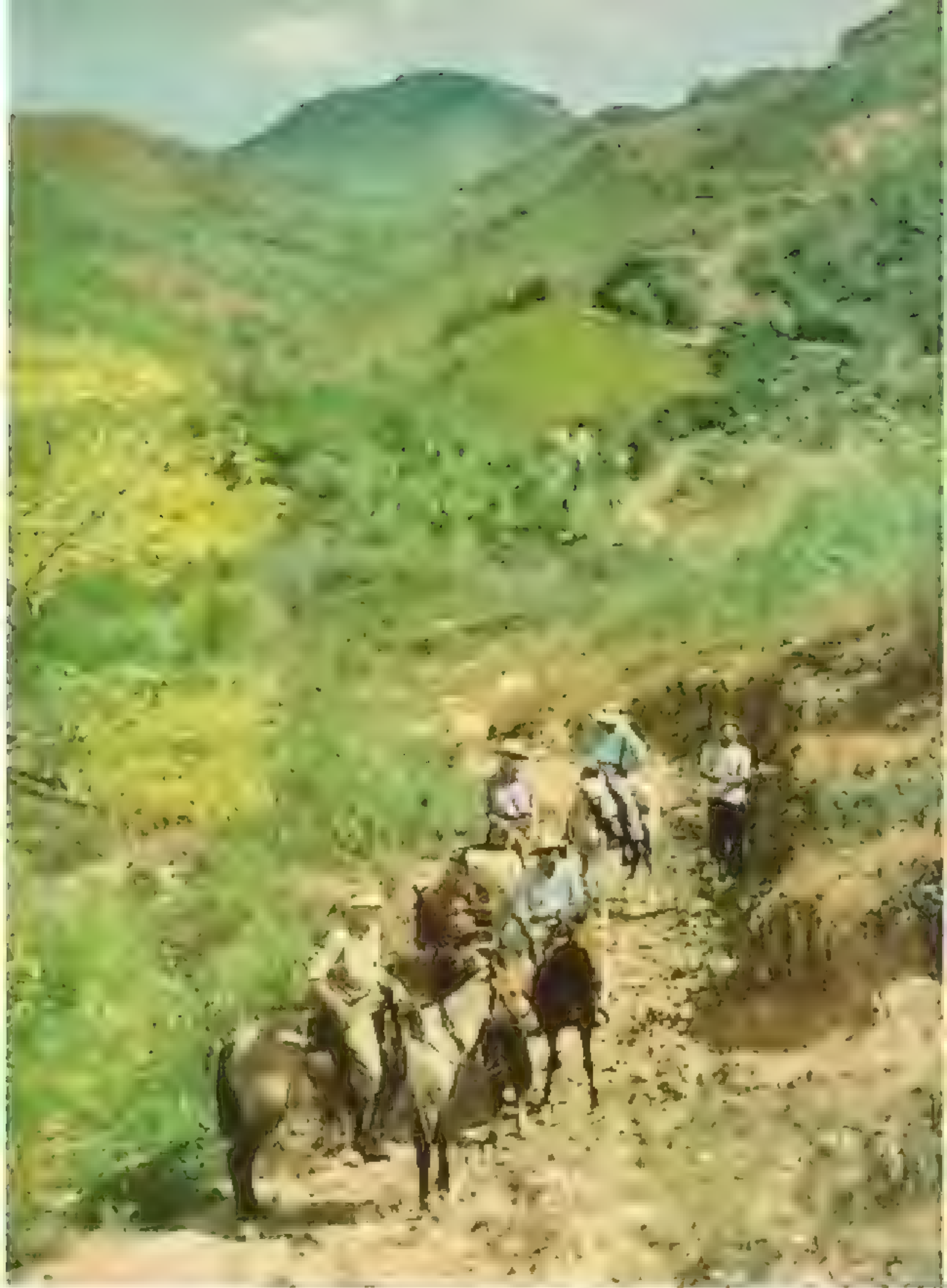
A Archaeologists Treading Prehistory Camp in the Jungle at Chumel

[illegible]

✶ **Repairing Your Broken 50 Years Ago**
Takes Patience and a Delicate Touch

But even if Mexico's economy is not growing as fast as the expectations were, there will still be a lot of money in the economy. The banks will be holding lots of dollars and pesos and the foreign banks will be holding lots of pesos and dollars. The money will be there.





Expedition Members Take a Rocky Trail to a Mountaintop Burial Ground of the Ancient

Sumatran People, 1911. The expedition, consisting of the author, Dr. H. H. Johnston, and Dr. J. H. Johnston, was the first to reach the burial ground. The site was discovered by the expedition in 1911. The site was discovered by the expedition in 1911. The site was discovered by the expedition in 1911.



A Lantern in Broad Daylight? Dr. Stirling Carries It to Light Cave Tombs in the Canyon
Distant Penonome stand on Valley which in Spanish was a popular resort for New Mexico Spaniards and
now is a town built by the Indians on the ruins of the old city.

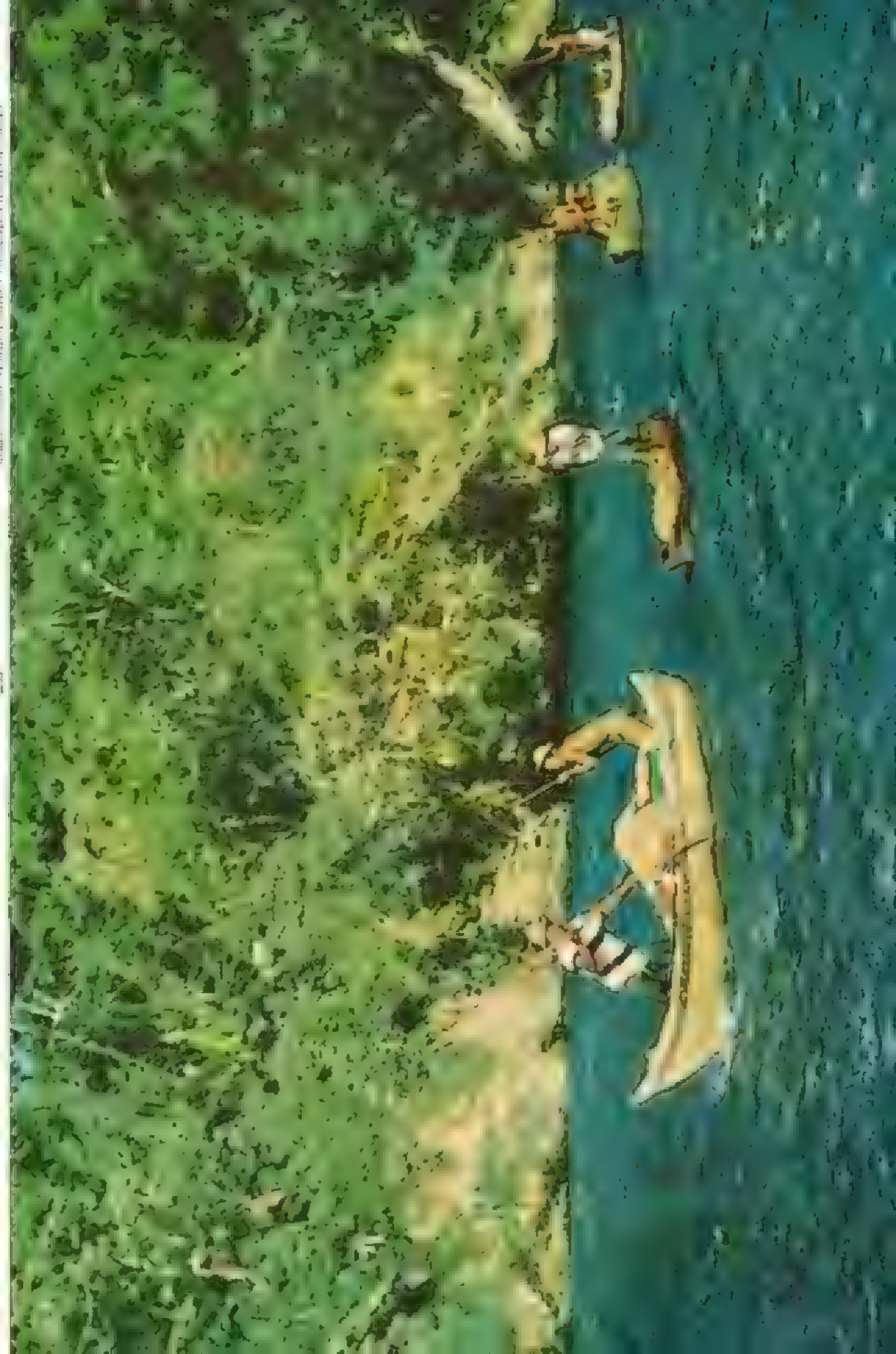


• Abolished When Carter Won (And The Sacred Regime in Atlantic Rock met In Pinned)

Theorem 1. Let $\{x_n\}$ be a sequence of real numbers such that $x_n \rightarrow 0$ as $n \rightarrow \infty$. Then $\{x_n\}$ is a Cauchy sequence.

• Poles Seize Where Puddles Will Not Go. Camera Pops Up the Sky and Shallow Rio Grande del Norte

The \mathcal{H}_∞ norm of the closed-loop system is given by $\|T\|_\infty = \sqrt{\lambda_{\max}(P)}$, where P is the solution of the Lyapunov equation $A^T P + P A + C^T C = 0$. The \mathcal{H}_2 norm of the closed-loop system is given by $\|T\|_2 = \sqrt{\text{trace}(P)}$, where P is the solution of the Lyapunov equation $A^T P + P A + C^T C = 0$. The \mathcal{H}_1 norm of the closed-loop system is given by $\|T\|_1 = \sum_{i=1}^n |p_i|$, where p_i are the eigenvalues of the closed-loop system.





**It's the Photographer's Birthday,
He Can Get in the Picture**

Sumner, a former U. S. senator, died at 77, having been elected to Congress in 1902, and re-elected in 1904 and 1906. He was an ardent supporter of the cause of the colored people, and was one of the founders of the National Association for the Advancement of Colored People. Mrs. Henry Sumner, nee Elizabeth, nee Johnson, of New York, died at 77.

✧ Zipping Shot the Mosquito Net Is Bedtime Ritual in the Jungle

The railroad has made the entire main line of the road available with all its facilities for the use of the Government. It has also made the entire main line of the road available for the use of the Government. It has also made the entire main line of the road available for the use of the Government.



and purple, with designs that clearly showed connections with the rich cultures that once existed across the mountain divide. It contrasted sharply with unpainted, simpler pottery we had found nearer the coast.

Polished stone axes and arrowheads in abundance resembled the coastal types, but a strong blending with the cultures on the Pacific coast also was evident.

The ancient Indians on the Pacific slope were quite advanced and knew, for instance, the art of gold plating base metals. They manufactured beautiful polychrome pottery, carved handsome ornaments of whale ivory, stone, and bone, and mounted emeralds and semiprecious stones in gold settings. Their lavish use of gold led to their early destruction by the Spaniards.

Competition for the Medicine Man

Dr. Gage set up a medical clinic in the schoolhouse. Suspicious at first, the natives finally began bringing their children for treatment. The women followed, and at last came the men, some from a day's journey away. Intestinal worms and aching teeth were the most common complaints, plus goiter, yaws, and infirmities of old age.

The local medicine man, who charges for his magic and herb remedies, was jealous and suspicious of this free service by an outsider. Dr. Gage's final triumph came, however, when this local "medico" also presented himself for treatment for an ulcerated tooth.

When we had acquired as large an archaeological collection as we could carry, we canoed downriver and retraced our hike along the coast to the Rio Salud. The next day we reached Colón, bade farewell to Dr. Gage, and loaded our equipment aboard *Tambalita* for the trip to the Corié del Norte.

Heavy seas at first forced us back, but the next day we arrived off our destination. Dick and Marion got safely ashore with the first canoe-load of baggage, but Bob Rands and I were not so lucky. Crossing the bar in the heavy surf on the second trip, the canoe twice veered sideways and heavy combers broke over us, half swamping the craft.

We hired a native, Domingo Santana, to guide us and started upriver in two large canoes rented from Vidal Gonzalez, the storekeeper. The larger craft, fitted with an outboard motor and named the "Queen Mary," took the other in tow. To help with our digging, we hired three of Vidal's men, Eusebio, Santiago, and Marcilia. About noon we encountered the first rapids and could no longer tow the second canoe.

From this point onward we spent more time out of the canoes than in them, pulling, pushing, and towing them through one series of

rapids after another (pages 277, 283). The river was a succession of rapids and deep stretches. In the latter we used the outboard, and in the former we used main strength.

Fig-eating Fish

Many huge wild fig trees grow along the riverbanks. When a gust of wind came, green figs almost the size of tennis balls fell into the water. Immediately the surface was churned by the rush of large fish. Domingo told us they were tarpon, which fairly swam in the river during the season the trees are bearing. The natives use wild figs as bait.

I was naive enough to throw out a plug at one of these spots. A fish took it almost immediately. Although the brake was on, the line screamed off the reel. Almost before I knew what had happened, all I had left was an empty reel and a blistered thumb.

That afternoon we reached Cinnola, a single thatched house where lived an old woman who reputedly knew of a prehistoric burial place. She led us up the riverbank to a terrace. After poking about in the jungle for half an hour, she halted and announced that we stood on the exact place.

The site did not look promising, so we asked for more details. Thirty years ago, it came out, she and her family had lived in a house on this spot. At night she heard noises under the ground that sounded like the clinking of coins. Ghosts of ancient inhabitants buried there were obviously counting their gold!

We asked why they had not dug it up themselves. She replied that they were afraid.

This was but one of many such wild-goose chases we experienced in our searches.

Hidden in the jungle near Cinnola, up the Arroyo San Antonio, we came upon remains of old Spanish gold workings. Tunnels dug probably by Indian slaves were still visible though long since collapsed. A few large millstones lay covered with undergrowth.

Meat from the Jungle

Our guide shot game for us. Our favorite was "painted rabbit" or paca. This large rodent, weighing about 20 pounds, has a delicious flavor resembling pork. Even tough tapir steaks became palatable when treated with a tenderizer and cooked Swiss-style.

We also shot an occasional deer or curassow, the latter a bird related to the wild turkey. Usually we were able to purchase rice and bananas from the natives and now and then some eggs and chickens. Palm nuts were abundant and palatable. Our only imported foodstuffs were dehydrated soups, a little canned fruit, cheese and similar luxury items.

We explored the Rio Cocleito to the head of canoe navigation, which was take-off point



Crossing a Stream Where it Enters the Caribbean Sea, the Party Wades through Surf

Dr. and Mrs. Stubbins and the four boys of the expedition, with the two men and two women, waded across the stream at Kono, and then continued on their way to the beach.



for a difficult two days' trail across the mountains to La Plata and Perennome, settlements we reached later by another approach. Three small native children were so afraid of us they hid at first. We gave their mother some hard candy, which they tried to swallow whole. The choking which resulted did not increase our popularity.

Ascending the Cascajal, we found it so full of rapids that our two large canoes could not be fully loaded. We therefore hired two additional small craft manned by Indians whose front teeth were filed to sharp points. They do this by placing one stone behind the tooth and pounding with another. The practice probably originated in Africa. These Indians think it not only adds to their good looks but also helps preserve their teeth (opposite).

Waterfalls, rapids, and fallen trees often blocked our progress (page 273). Eventually the stream opened into a deep, calm lake, and we made camp, dry for once, on a hilltop.

From here we could see the Cerro Iguaña (Hill of the Iguaña), about 2,000 feet high, which marks the Continental Divide. In four days' work we obtained a good collection of pottery fragments and stonework.

It began raining the afternoon of the final day and poured all night. We got up at 5 a.m. and broke camp in the dark and the deluge. At a house a little distance downstream we picked up our outboard and other extra equipment left there on the upstream pull.

To help carry our collections, we hired a small canoe manned by two Indian boys and loaded it with picks and shovels, food, and archeological materials in rubber sacks.

Guiding it downriver, the boys had a fine lark, fishing as they went. One specimen they caught must have weighed 10 pounds. We did not see how they got through the rapids in their leaky, overloaded canoe, which had only about an inch of freeboard.

With the worst obstacles behind us and our archeological work accomplished, it was time to relax and enjoy the trip downstream. Had we known what lay ahead, we would not have been so carefree!

Trouble in the Rapids

Early in the afternoon we came to the last bad rapid. Here the river forks past an island. The right branch is shallow, and the main body of water follows the left channel. The water drops about 10 feet in a distance of 150 feet at the apex of the rapid, where it makes a right-angle turn.

Scarcely in the angle of the turn protruded the skeleton of a large tree. The number two canoe, needing less water than the big one, took the right channel. The swift current made hauling it through shall water fairly easy.

Domingo elected to take the "Queen Mary" down the left-hand, deeper channel.

As we came to the angle, the force of the water was greater than Domingo expected, but by thrusting against one of the limbs of the fallen tree he barely prevented the bow from sweeping under it.

Suddenly disaster struck. An eddy caught the canoe and swung it like a cracking whip against the tree. Eusebio and Dick were swept off by a limb, and the stern was forced under. The men managed to hang onto the limb, which was over the swiftest part of the rapid, but the craft filled and overturned.

Marion, in a raincoat and big sun hat, swam out into the current. A poor swimmer, I clung desperately to the bottom of the canoe. I could not hold my grip, but the current was so swift that, by the time I slipped off, the canoe and I had been carried down to a sandbar in midstream where the water was only waist-deep. Marion found footing alongside me, clutching Bob's suitcase and typewriter.

Boxes, bags, and cartons were floating downstream all over the place. Eusebio and Domingo managed to beach the canoe on a shallow bar. Bob, Marcilio, and Santiago hauled their canoe ashore and hastily began gathering in the floating equipment. Domingo and Eusebio worked an empty canoe along the bank and picked up Dick, Marion, and me.

Cameras Sink to the Bottom

Our outboard motor, badly damaged, would not start. Dick's small movie camera, two still cameras and extra lenses, and a heavy movie camera had disappeared. We urged the men to hunt for them, but they were pretty well exhausted and felt the effort would be futile.

Only Santiago carried out the search, probing and diving in the deeper channel. After half an hour he found one movie camera 200 yards below the point where the canoe went over. In another half hour he located the still cameras and lenses.

Santiago also found two of our most important sacks of archeological material, thereby salvaging many of the scientific results of the upriver trip. Everything, of course, was saturated, even the things in tied rubber sacks. Cartons fell apart, and our food, except for canned goods, was ruined.

We finally reloaded the canoes and drifted downstream, pausing for a supper of wet cheese and crackers. The rain stopped before dark and there was a half moon. The lower river was calm and beautiful in the pale light.

We reached Cocle del Norte before midnight, the third time we had arrived there, and the third time we had arrived soaking wet!

In the morning we hung up our equipment

to dry and stand out in the sun. Unfortunately the flapping of the canvas was ruined.

Early that morning we heard the sound of a motor overhead and were surprised to see a helicopter coming down to land. The pilot proved to be Capt. Hal T. Beck of the U. S. Air Force's First Rescue Squadron at Fort Belvoir, Kan. in the United States.

Captain Beck had come to investigate the human skull and bones found in the interior by our hunter, who, he said, has made in the course of his American pilot tour during World War II. A reward had been posted for information about his fate.

After examining the skull, I was told to identify it as that of a wild, diseased native woman.

Since Dick was now on his way home, I took him to the new quarters and showed him the stream that had spoiled the river. The stream had been few feet to the west.

Next morning *Lamaca's* arrival team began and her crew quickly moved to take us north to the camp. There were more than 150 canoes and we were to be put aboard our heavy boat for the 30-foot canoe.

Now it started raining and it was not that long before we were in the water.

When we got out from the river, the sea was rough and the waves were high. They were not good and would make only one boat. The crew of the *Lamaca's* and my boat were put aboard. A native, a woman and a child were also aboard.

We had no things with one of the men who was not with us. The boat was so full that it was impossible to move that day with a heavy load.

Meanwhile the crew were, fortunately, all out of the boat in time to go out with us. My boat and I sat on top of the cargo.

Those at the camp were not left and two of them had a long, heavy pole to



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Teeth Chipped to Points Are a Mark of Male Beauty

An Indian woman, who is a member of the tribe of the *Lamaca's*, is shown in the photograph. She is wearing a necklace of teeth and a bracelet of teeth. The teeth are chipped to points and are used as a mark of male beauty.

use in crossing the bar and a paddle for the crew. We did fairly well at first but near the river mouth we hit the rocks and the boat was damaged. The crew was not in the water as we were being pulled.

Waves Nearly Swamp Canoe

We had just turned paddle to the right to reach a spot where the waves were less heavy when a big comb hit us, putting a canoe on its side. We were the only ones left.

Meanwhile we were in the water. We were the only ones left.

In a few minutes a boat was pulled out of the water and the crew was saved. The boat was not damaged and the crew was not hurt. The boat was pulled out of the water and the crew was saved.

The dugout was almost awash. One of the crew threw down his paddle and started bailing frantically, and I joined him. Our bailers were plastic army helmet liners.

Mendoza was magnificent, not only piloting his paddle but shouting orders, keeping the crew working together and straining. At first we seemed to make no progress in bailing, but at last the level began noticeably to go down.

Finally Mendoza said, "We are moving ahead again! Keep working!" After what seemed an interminable time we passed the last line of breakers and reached the big rollers of the open sea. We were safe, but all the chickens were drowned.

Linked by Sea Baptism

As the transfer to *Tumbaita* was completed and the canoe was about to return to shore, Mendoza said, "You must be sure to write to me. We all belong to the same family now as we have been reborn together!"

Had one more breaker hit us, we would have been swamped. To swim in the heavy surf would have been impossible. We never should have embarked with such a heavy load, but did not realize how badly overloaded the canoe was.

Missing the boat would have meant a two-week wait until *Tumbaita's* next trip. Furthermore, the wind had been rising all morning and the surf was heavier than on the two earlier trips.

Safely back in the Canal Zone, we again spread out our things to dry, this time at Ancón in the yard of old friends. Paul and Betty Bentz. Our water-soaked waxes and radio had to be restored to working order. The archeological collections, after drying out, went into the Bentzes' basement for temporary storage.

Now we were ready for the last leg of our trip across the mountains from the unfriendly land that had so nearly defeated us. There we hoped to find remains of ancient cultural connections between that upland region and the country we had just explored on the one hand, and the better-known cultures of Panama's Pacific lowlands on the other.

Goats Move Out, Explorers Move In

In La Pintada, a picturesque village northwest of Penonomé (page 281), we rented an earth-floored, tile-roofed adobe house from the local Chinese storekeeper, who obligingly drove out the goats and cattle living there.

Marion gathered sweet-smelling orchids known locally as *betanana Santa* (Holy Week) to counteract somewhat their odor.

In the nearby mountains volunteers from La Pintada helped us locate caves that were aboriginal tombs. Some of these were dangerously placed on the faces of high cliffs, up which the bodies were carried. This method of burial has not been previously reported from Panama, nor is it mentioned in early accounts.

With the memory of our recent narrow escapes still vivid, I felt as I climbed up to them somewhat like the cat which already had lost eight of its nine lives.

Two wide expanses of bare rock, one on the side of a high hill and the other in the middle of a stream, were covered with spectacular and mysterious petroglyphs (page 282).

Old friends, the Conte family of Penonomé, led us to a tomb site near a place called El Lámón in the mountains (page 279). There don Miguel Conte had discovered a fine collection of new-type pottery, which he presented to us for the U. S. National Museum.

Last Find Richest of All

We next moved to Majata, on the Peninsula de Azuero, pitching our tents not far from the town of Ocú. Here we found the richest of all the sites we worked that season in Panama. It yielded a magnificent collection of polychrome pottery representing a new variant of the high Coelí culture of the Pacific slope (page 278).

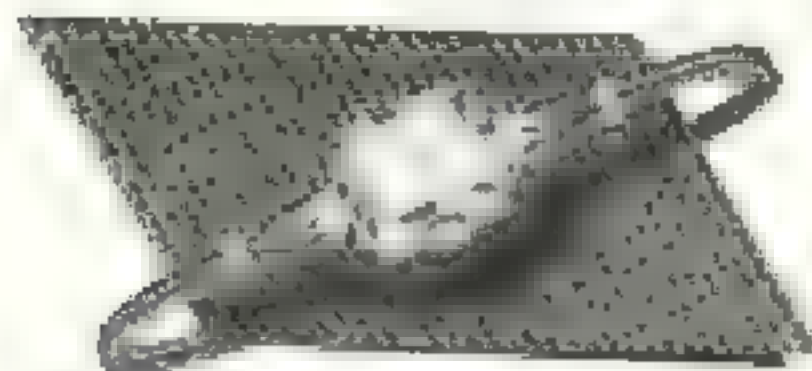
One of the practices of civilized tribes in Middle America was the burning of copal, or resin incense, in their religious ceremonies. At one place in the Mojara site we found a cache of more than 200 spoon-shaped incense burners with about 100 little hourglass-shaped stands made for them to rest upon after heating when the incense was smoking properly.

Archaeological material thus far excavated in Panama generally demonstrates a relation with South America. Gold ornaments in the form of frogs, birds, and other animals and the method of plating copper with gold are characteristic of northwestern South America. The method of burying the dead in deep chambers hollowed at the base of a vertical shaft is also typical of both regions.

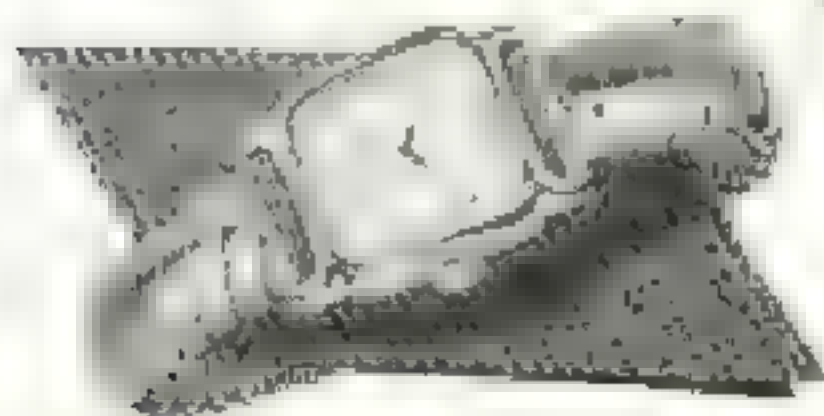
Our excavations in Panama up to the present support the belief that the pre-Columbian Indian civilizations there were mainly developed from South American origins.

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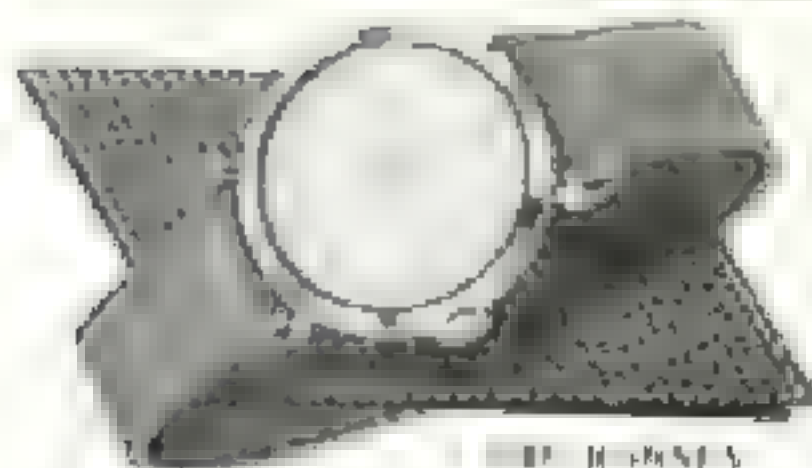
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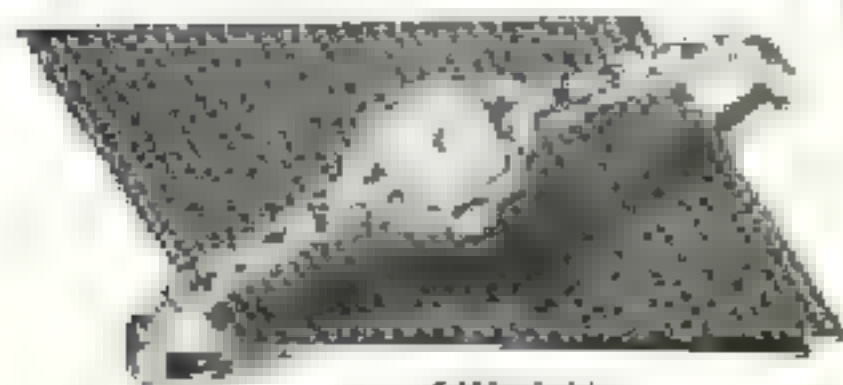
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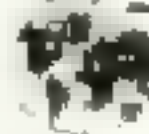
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RESULTS

Journal Club

Abstract

July 2, 1988 **Saturday**

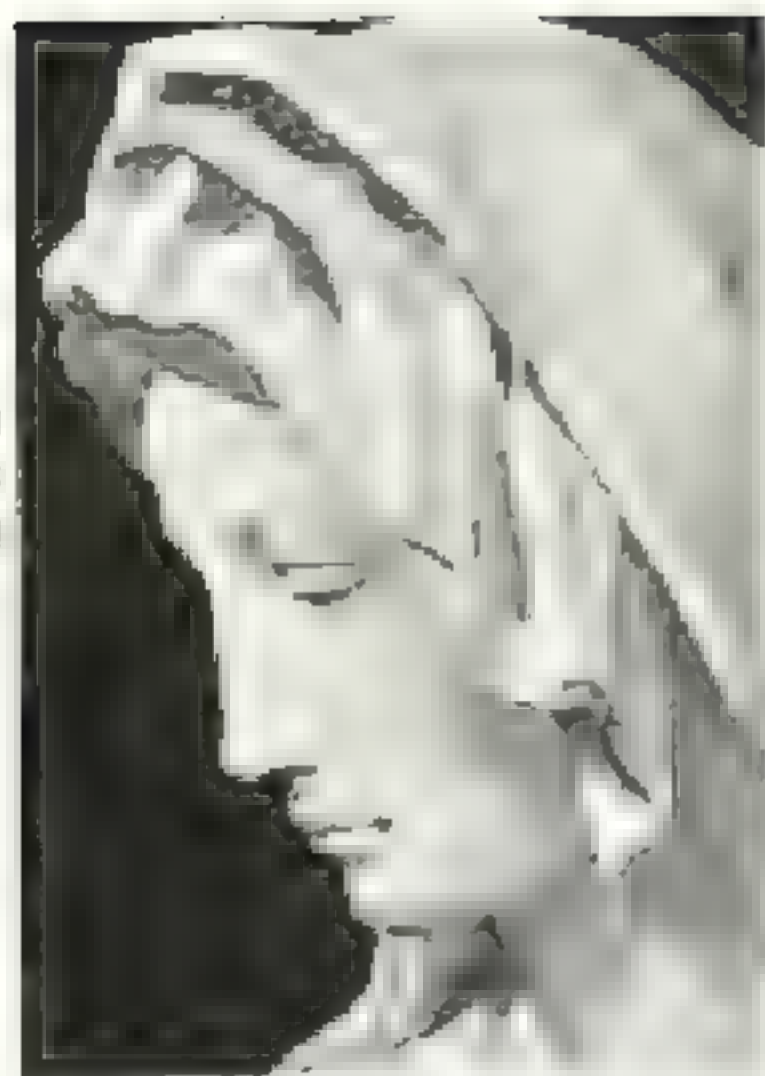
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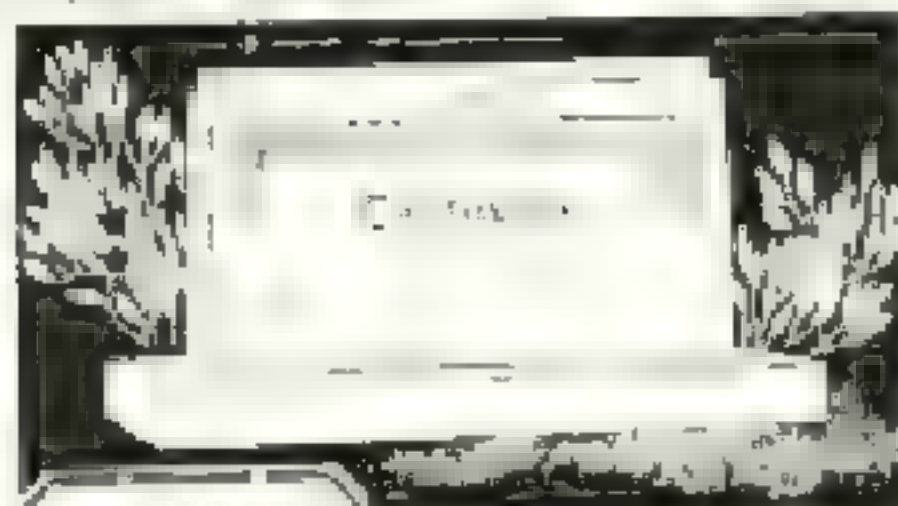
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(FOR AUGUST)



Where is a plant worshipped as a god?

- ☐
- Sign up**
- ☐
- Attend**
- ☒
- Informing**

to your date or you appear alone.
When he finds out how we have
~~been~~ ~~and~~ ~~consequently~~ ~~in~~ First
Season I look at some Third-
Year students and find what they
need. Only my own words.

What is the world's busiest canal?

- ☐ **Print document** ☐ **Save** ☐ **Sign**

The State further is bound to secure the health of its people by proper police. Whether carried out in the name of the State, or in the name of the community, such a duty is imposed by the duty of the State to secure the health of its people by proper police.

Where will you find "The Granite City"?

- ☐
- Italy
- ☐
- Scotland
- ☐
- Turkey

It was not until the 1980s, however, that the American National Commission on the Causes and Prevention of Violence, the National Institute of Mental Health, and the American Psychological Association began to take a more active role in the study of violence. The American Psychological Association, for example, has been instrumental in the development of the Diagnostic and Statistical Manual of Mental Disorders, which is the standard reference for mental health professionals.

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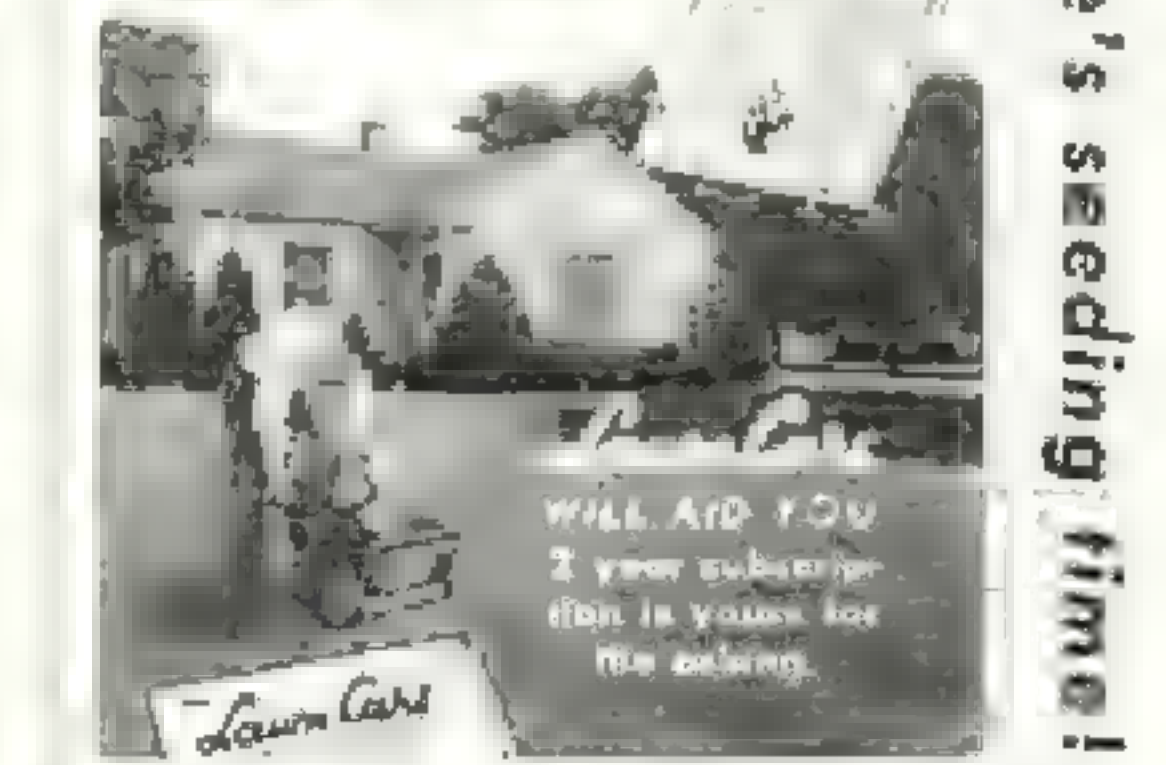
PREFACE

FALL is the right season
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Care". The current issue explains why Sun-
down is so good for you, and gently but
firmly gives you a good healthy wash
down. It's a good idea to get a copy of
"Lawn Care" for your lawn. The copy
you get will be a good one.

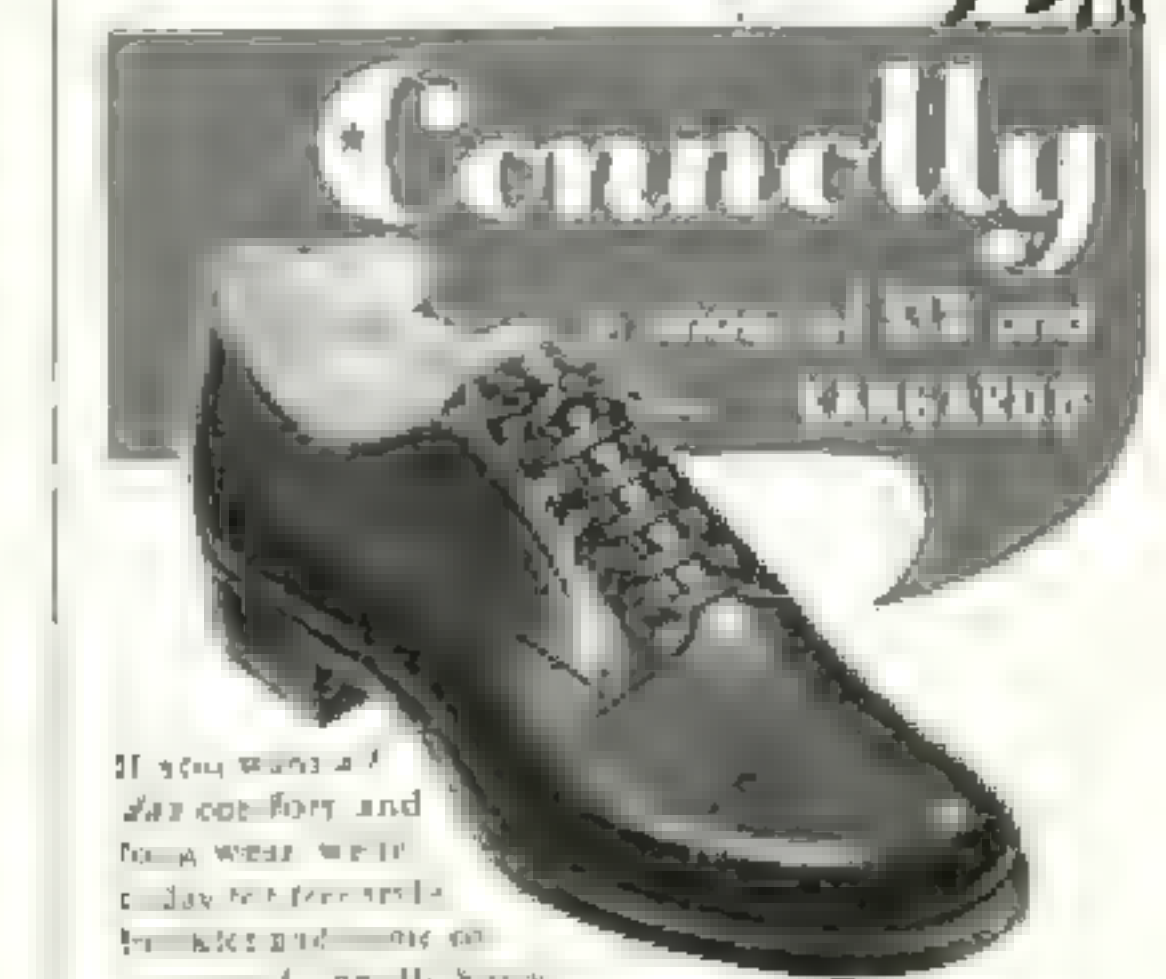
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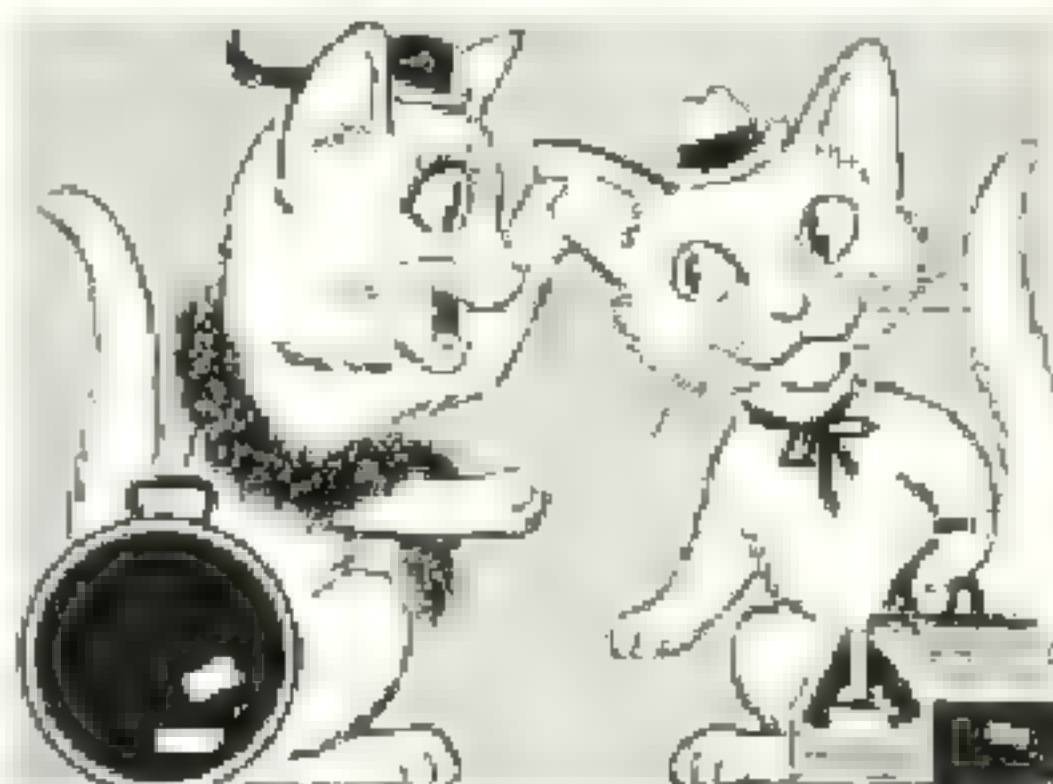


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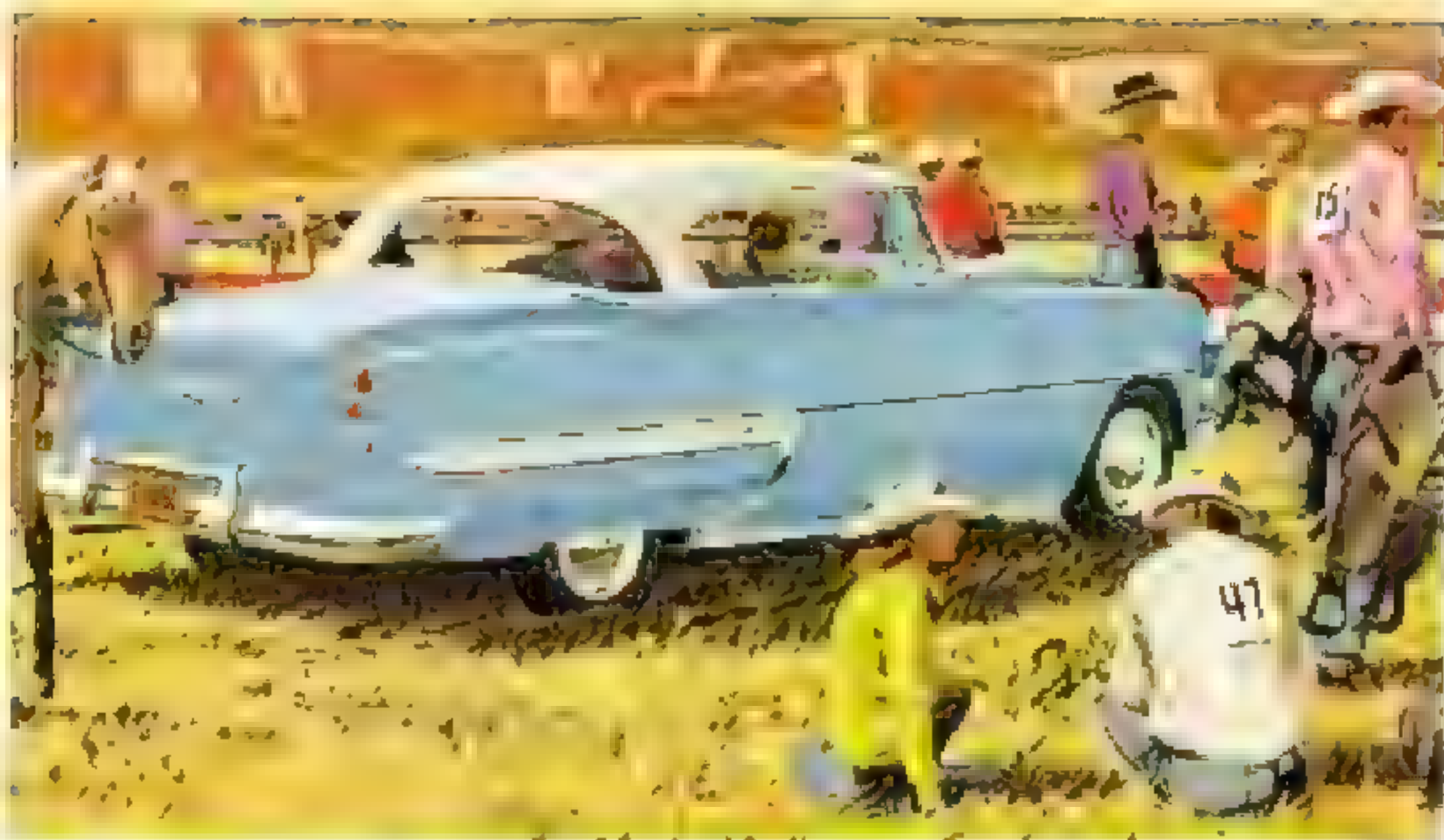


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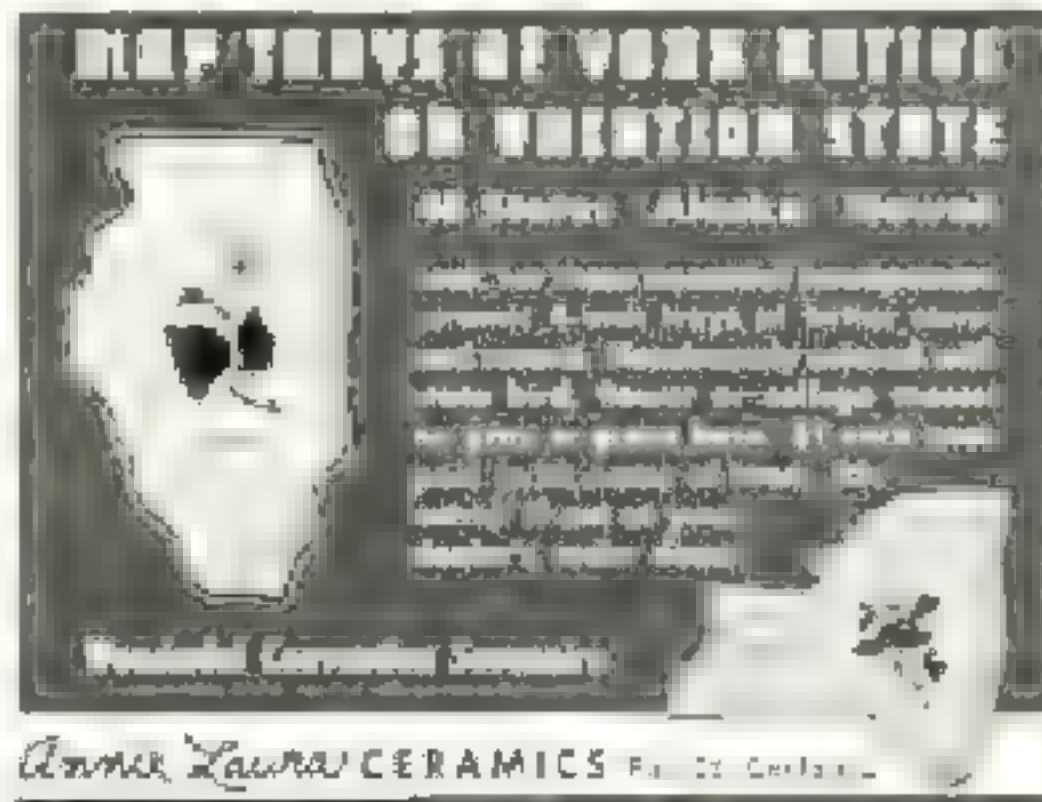
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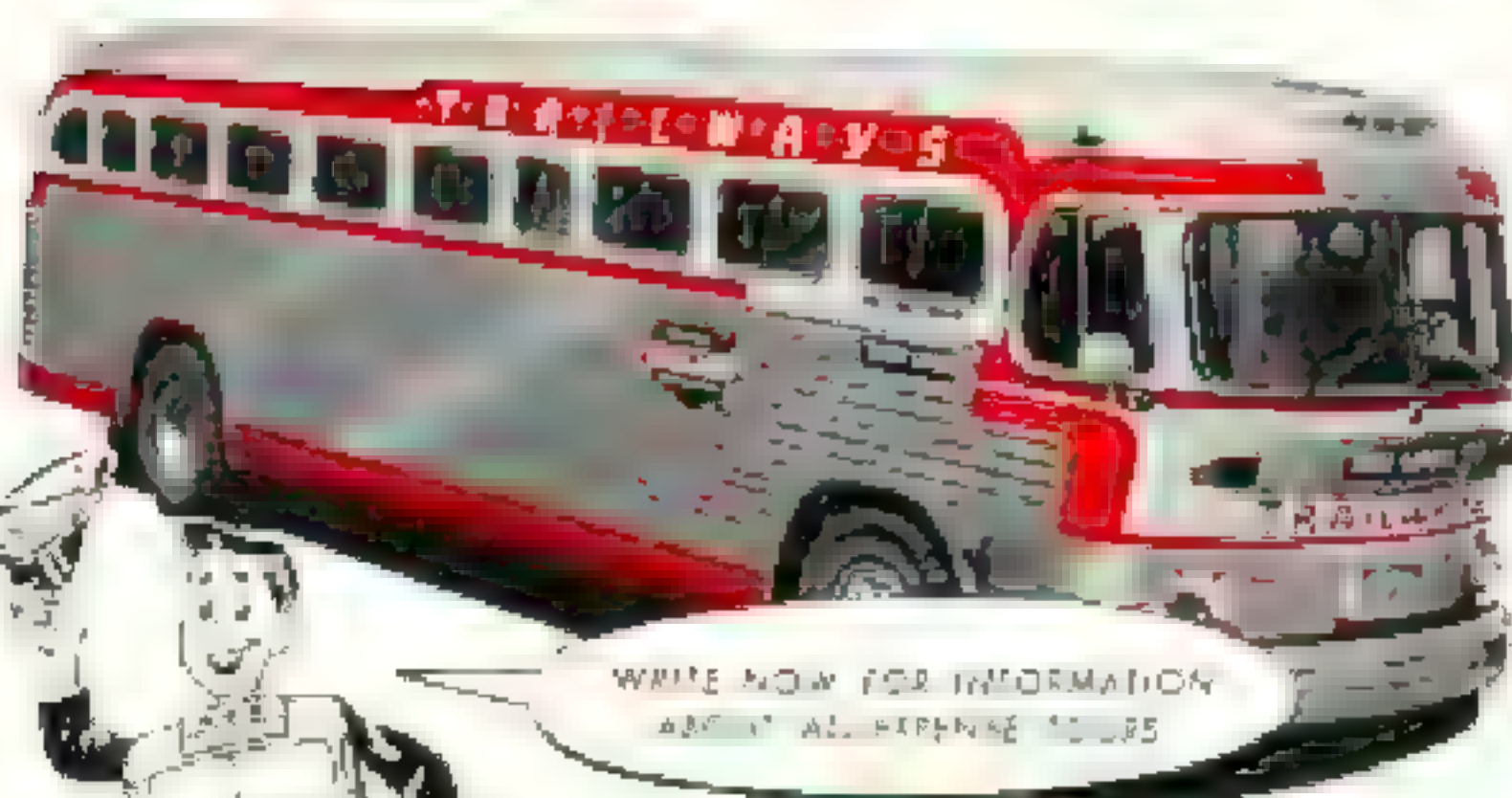


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Great advances have been made in research on child, adolescent, and elderly patients, but the medical community has not kept pace. Today, for instance, there are no standard clinical or laboratory measures of sleep and circadian work. Of immunological variables, only the cytokines IL-1 and IL-6 are

the most common, and most useful, generalization of the linear production function is the Cobb-Douglas production function, which has the form

$$Q = cL^aK^b$$

where c , a , and b are parameters to be estimated. The Cobb-Douglas production function is useful because it has several desirable properties. Some parameters of interest are particularly easy to interpret. For example, according to the Cobb-Douglas production function, the elasticity of output with respect to labor is a , the elasticity of output with respect to capital is b , and the sum of a and b is the elasticity of output with respect to total inputs.

Although the above discussion is based on the fact that the two variables are dependent and the two variables are not independent, such a discussion is not sufficient, as the above discussion is based on the fact that the two variables are dependent and the two variables are not independent.

Although the reasons for the "spare wheel" are many, the fact that the "spare" program was established before the "go" program was started, has helped.

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[illegible]

Figure 1

Name _____

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To the

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Thus, for the purpose of steps p— where the steps of the Algorithm are defined— we have $\text{Step } p = \text{Step } p + 1$ while the Algorithm terminates when $\text{Step } p = \text{Step } p + 1$. The above Algorithm can be modified to the following Algorithm:

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 the new road, the new road, the new road,
 the new road, the new road, the new road,
 the new road, the new road, the new road.

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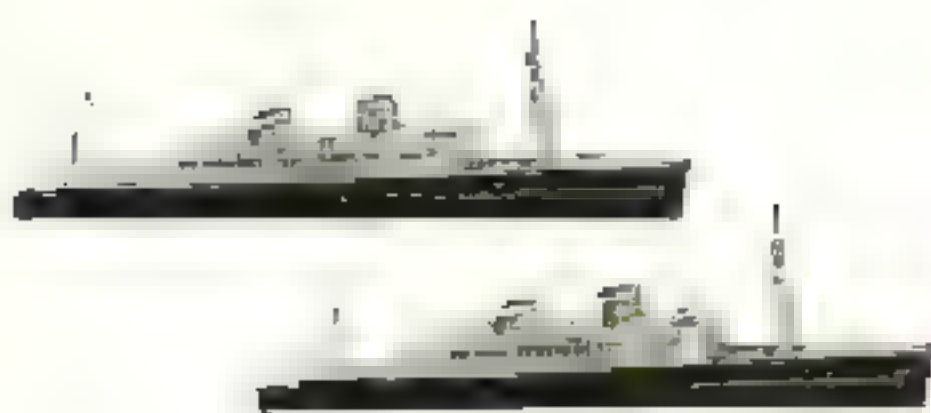
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Al Tunall

Al Tunall, 34, is a member of the Santa Fe Railway's "Movie Camera Club." He has been taking snapshots since he was 12. He is a member of the Santa Fe Railway's "Movie Camera Club."



Q. **What do you like to do when you're not on the train?**
A. I like to take snapshots. I like to take snapshots of the people and the scenery. I like to take snapshots of the people and the scenery. I like to take snapshots of the people and the scenery.

Q. **All right, movies are wonderful. But aren't they hard to make?**

A. Not much. I like to make movies. I like to make movies. I like to make movies.

Q. **How do you make movies?**
A. I make movies by taking snapshots. I make movies by taking snapshots. I make movies by taking snapshots.

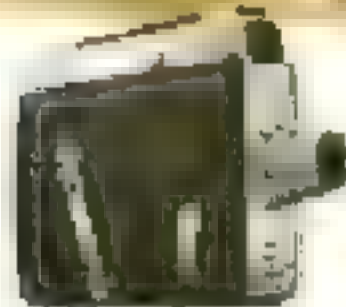
Q. **What do you like to do when you're not on the train?**
A. I like to take snapshots. I like to take snapshots. I like to take snapshots.

Q. **So it's easy to make good movies. But the cost?**

A. Well, you can make a good movie for \$20.00. You can make a good movie for \$20.00. You can make a good movie for \$20.00.

Q. **What do you like to do when you're not on the train?**
A. I like to take snapshots. I like to take snapshots. I like to take snapshots.

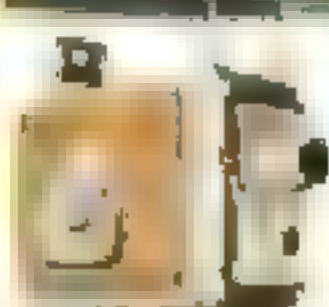
Q. **What do you like to do when you're not on the train?**
A. I like to take snapshots. I like to take snapshots. I like to take snapshots.



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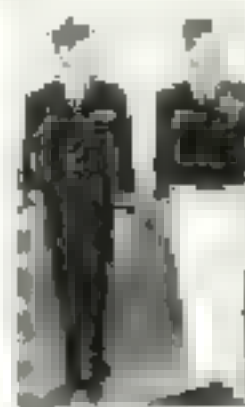


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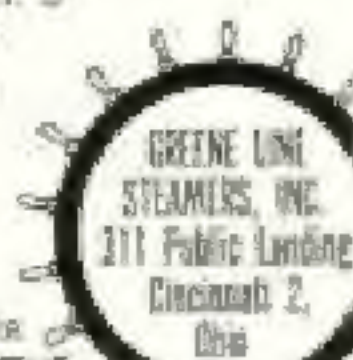


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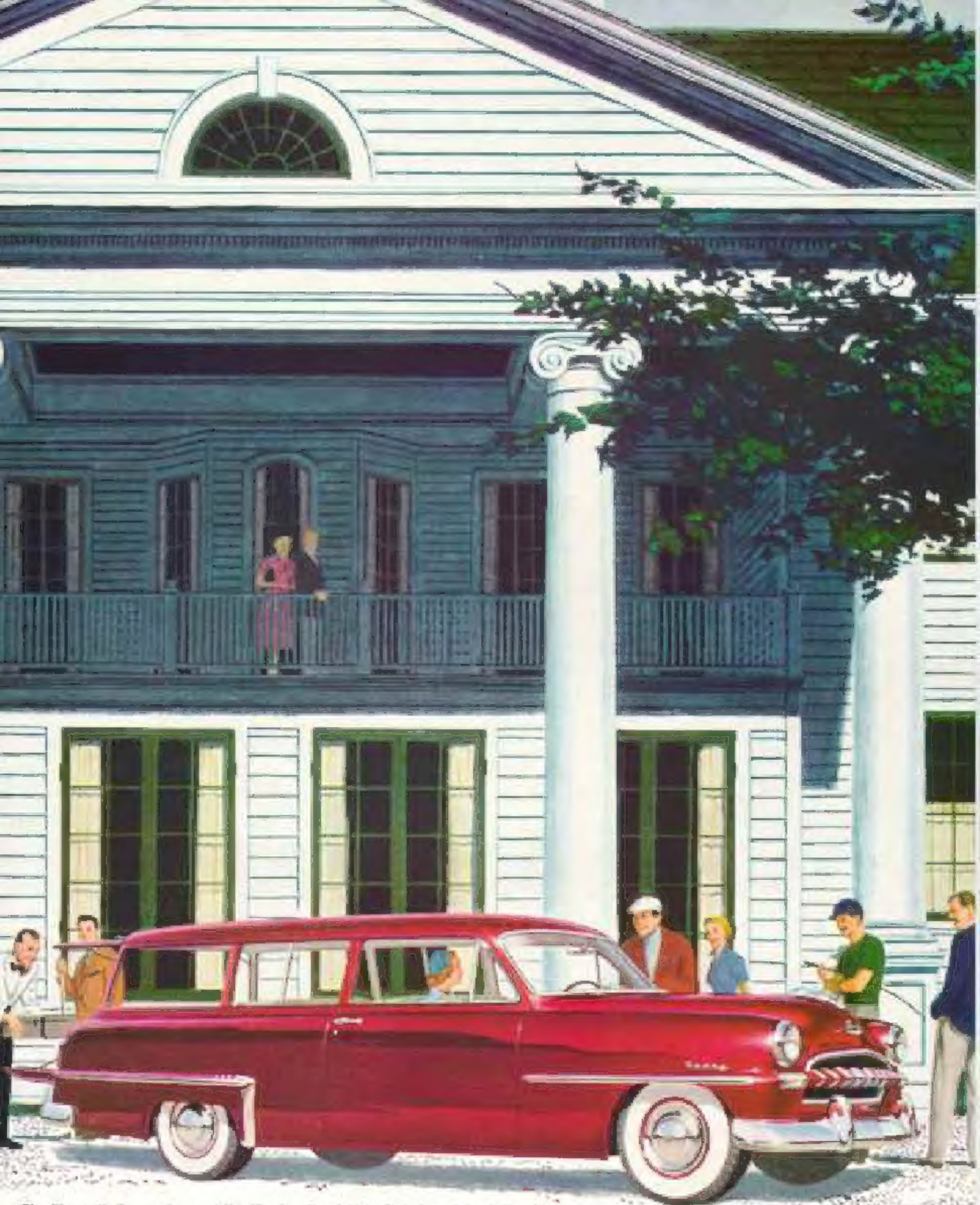
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